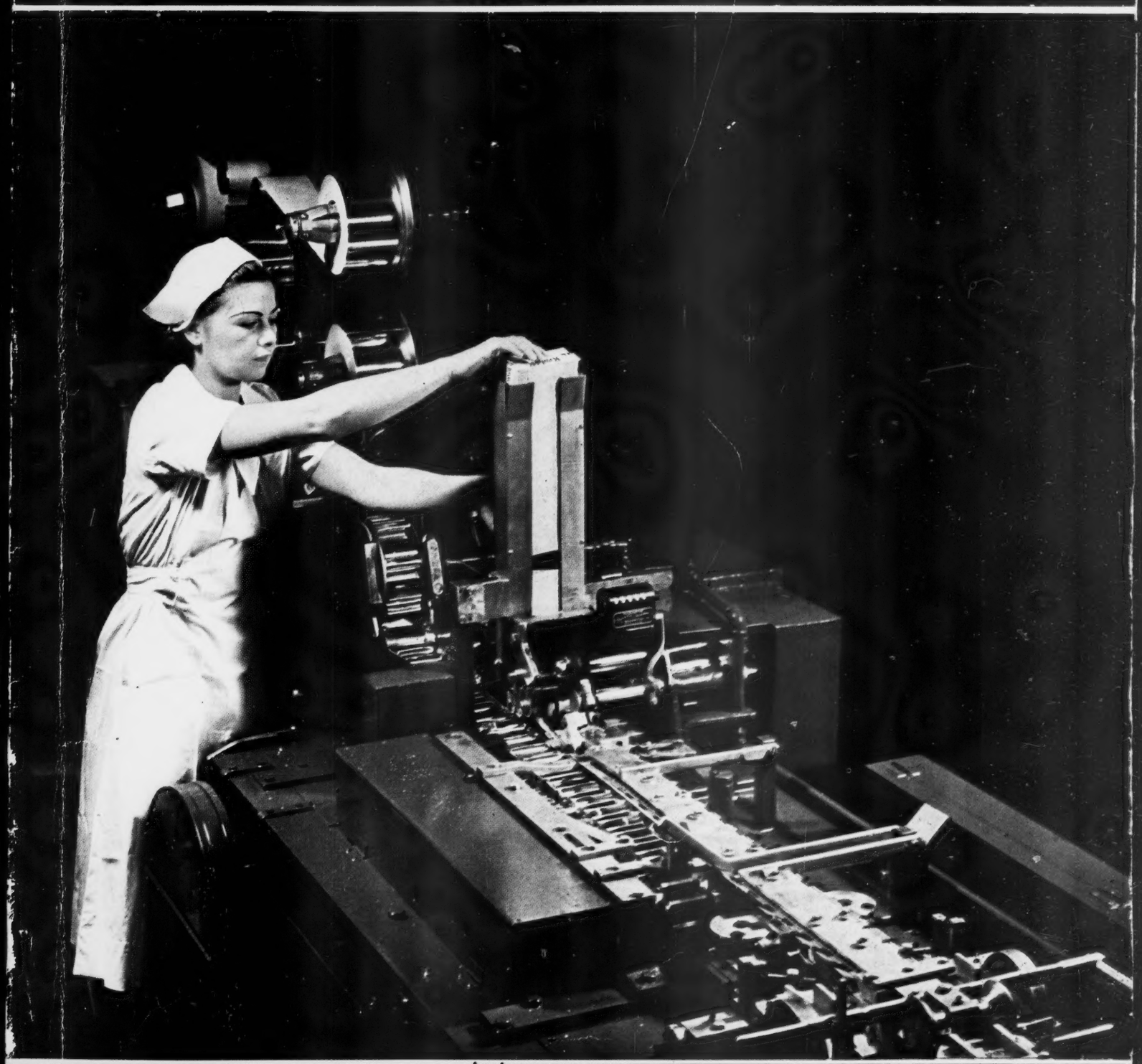
JANUARY, 1939

FACTORY

MANAGEMENT and MAINTENANCE

A McGRAW-HILL PUBLICATION



In this Issue: "AMEND THE LABOR LAW, CHANGE THE BOARD"

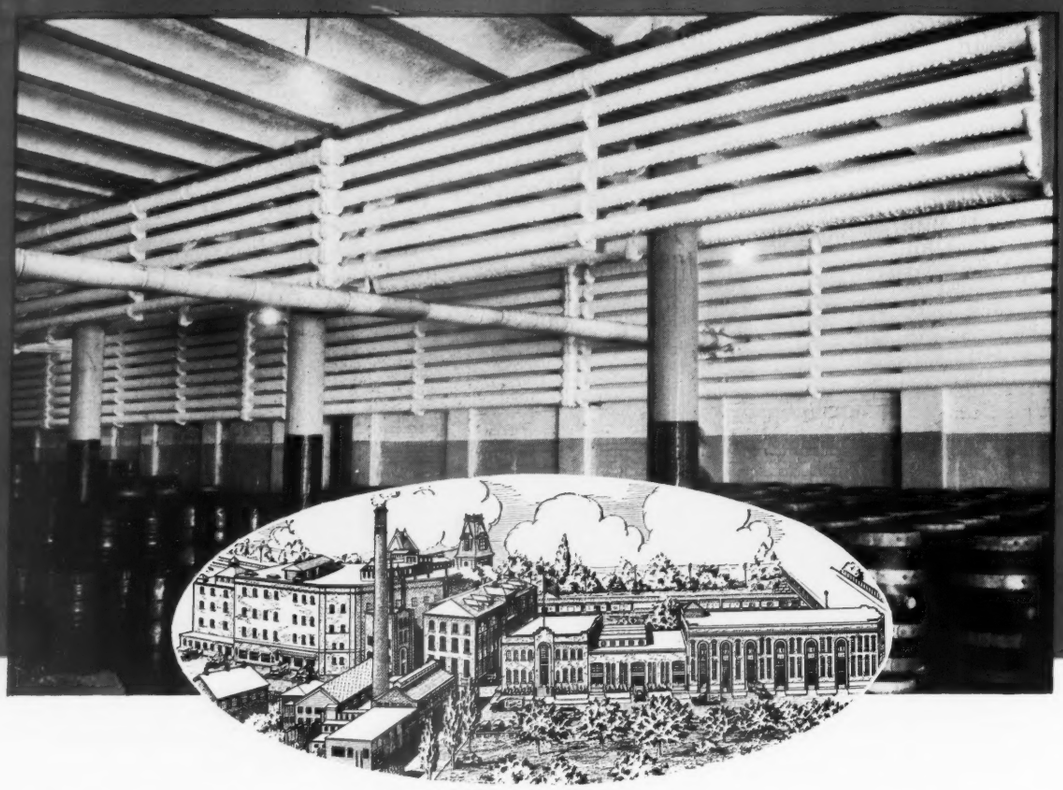
CALL THE ROLL OF FAMOUS Narragansett LAGER & ALES AMERICAN INDUSTRY

Pale Ale · BANQUET ALE · Select Stock Lager

Genuine WROUGHT IRON

COMBATING CORROSION

IN NEW ENGLAND'S LARGEST BREWERY



Famed for Quality, the products of Narragansett Brewing Company, Cranston, Rhode Island, are distributed throughout the New England States, and elsewhere. The company's solution of its corrosion problems is based on experience covering over 30 years' service.

Wrought iron is used for all direct expansion ammonia cooling coils, as illustrated; all ammonia lines; cold water lines; steam return lines; and well casings. Well casing installed over 30 years ago is being re-used for water lines; drain lines from ammonia cooler; condensate lines; and some outside blowdown lines. The ability of genuine wrought iron to solve a wide variety of corrosion problems is well illustrated in this one plant.

No list of applications can properly suggest all of the places where Byers Wrought Iron may save for you. If you have a corrosion problem in your business, and will write us details, our Engineering Service Department will determine the probable corrosive conditions; relate these to similar conditions encountered elsewhere; interpret the results in terms of experience gained in 75 years' contact with corrosion problems . . . and make recommendations, supported by actual service records. There is no cost or obligation.

A new Byers General Catalog has just been published. Ask for a complimentary copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

BYERS GENUINE WROUGHT IRON

TUBULAR AND FLAT ROLLED PRODUCTS

Specify Byers Genuine Wrought Iron Pipe for corrosive services and Byers Steel Pipe for your other requirements

FACTORY MANAGEMENT and MAINTENANCE (a consolidation of Factory and Industrial Management (including "Factory") and Maintenance Engineering), Jan., 1939, Vol. 97; No. 1. Published monthly. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and executive offices, 330 West 42d Street, New York, N. Y. Entered as second class matter, November, 1936, at Post Office, Albany, N. Y., under the Act of March 3, 1879. Price 35c a copy. Subscription rates—United States, Canada, Mexico, and Central and South American countries, $3 a year. All other countries, $4 a year or 16 shillings.

"RUSH TRACTOR BY AIR MAIL"

A typical example of Goodrich development in rubber

THAT'S the wire a Hollywood motion picture company sent an Indianapolis tractor maker. Tractors just can't be sent by air mail but one *was* rushed by express, with an express bill of $1170.

Why the frantic need, when there are thousands of tractors available nearby, in California? The movie people needed a *fast* tractor that could be built up with steel sheets to take the part of a fast tank in their picture "Army Girl." Nothing but the Marmon-Herrington tractor would do, because its tread is an endless band of rubber—specially developed by Goodrich—enabling it to travel seven times as fast over rough ground as a tractor with old-style steel treads.

This new kind of tractor was developed for oil country work, road building, and similar industrial uses where speed and abrasion wore out steel tracks in a hurry, and where any speed above a crawl "threw" the steel tracks off their sprockets.

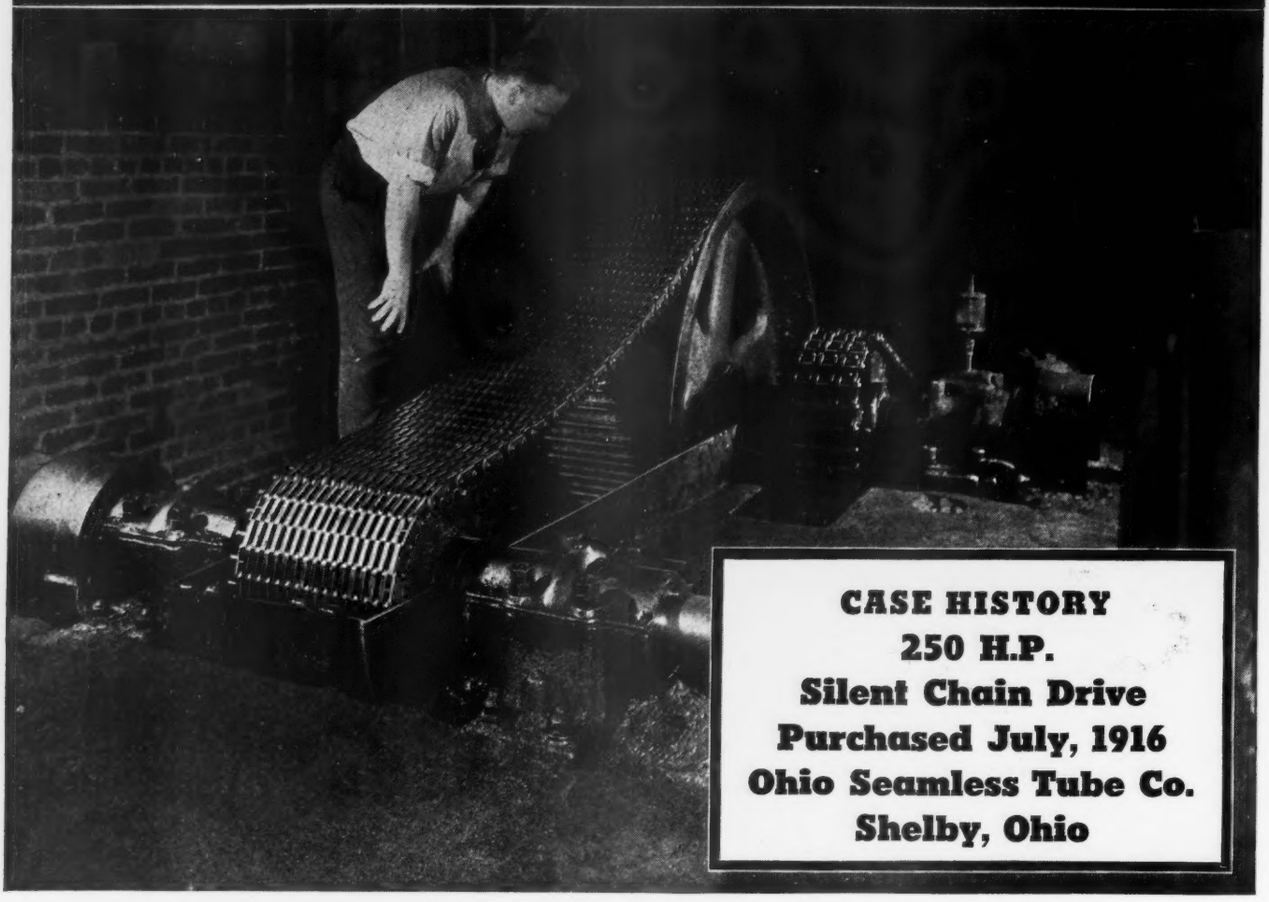
The tractor was literally made possible by its rubber track. The manufacturer had an idea, but only an idea. Goodrich worked with him, and developed a rubber compound able to stand the terrible abrasion and pounding of such service. This was made into a track with cables imbedded in the rubber to prevent stretching and "throwing" the track.

This is a typical example of the research which goes on constantly at Goodrich—research applied to both new and standard products. It is because of this Goodrich attitude—of applying research constantly to everything—that users of Goodrich belting, hose, tanks, rolls report such long life, low cost, satisfactory service. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

Goodrich

ALL *products problems* IN RUBBER

SILENT CHAIN PERFORMANCE FACTS



CASE HISTORY
250 H.P.
Silent Chain Drive
Purchased July, 1916
Ohio Seamless Tube Co.
Shelby, Ohio

REPAIR PARTS COST ONLY $3.19 PER YEAR —here's proof of amazing cash savings!

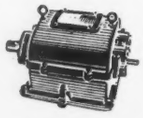
● When it comes to long life and low maintenance expense there is no other type of drive that can even approach the efficiency of the Link-Belt Silverstreak silent chain drive. It requires practically no attention and little upkeep. Definite proof of this is illustrated above—the chain drive shown has been operating steadily for 22 years and has required in all that time a total repair cost of only $70.00, which figures a mere $3.19 per year. Think of this the next time you buy a "drive." Get your money's worth—specify Link-Belt Silverstreak Silent Chain Drives! Send for Data Book No. 125, also for books on any or all of the Link-Belt positive drives illustrated below. Link-Belt Company, Indianapolis, Chicago, Philadelphia, Atlanta, San Francisco, Toronto. Branch offices and distributors located in all principal cities.

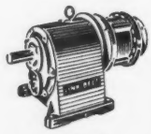
7505

ROLLER CHAIN DRIVE

P.I.V. GEAR SPEED VARIATOR

V.R.D. VARIABLE ROLLER DRIVE


HERRINGBONE GEAR REDUCER


MOTORIZED REDUCER

WORM GEAR REDUCER

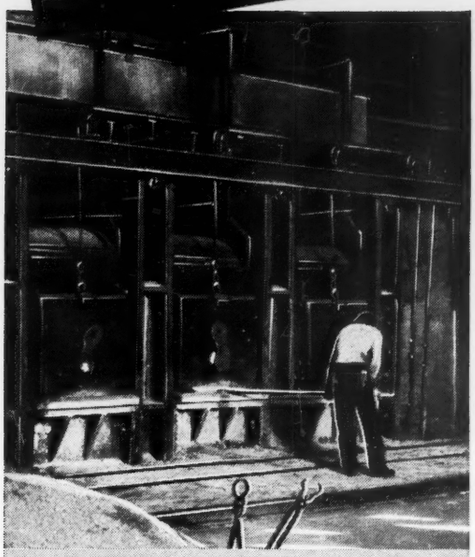
1939
NEW YORK WORLD'S FAIR EXHIBITOR METALS BLDG.

LINK-BELT

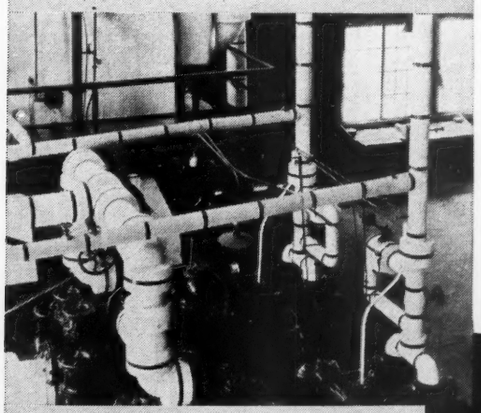
SILVERSTREAK SILENT CHAIN DRIVES

ARE YOU GETTING YOUR SHARE OF THIS $250,000,000 A YEAR?

Over a quarter of a billion dollars . . . that is the staggering amount J-M Insulations save American Industry *every year* by reducing fuel and refrigeration costs. And here is how you can be sure your plant receives its full share of this huge saving . . .



$11,000 ANNUAL SAVING — In 1927, the regenerators and flues of this open-hearth furnace in a large Ohio steel foundry were insulated with Johns-Manville materials, applied in accordance with the recommendations of a J-M Insulation Engineer. The net fuel savings *every year* have been more than 400% of the cost of insulation.



SAVING FUEL, INCREASING EFFICIENCY —This power plant is typical of hundreds all over the country that are saving thousands of dollars in fuel annually because all their equipment and piping is correctly insulated with the right types and thicknesses of J-M Insulations.

THERE is only one way to assure maximum fuel savings and greatest operating efficiency . . . that is by using the *correct thickness* of the *right insulation* for every service.

And there is one sure way to solve the problem once and for all . . . call in a J-M Insulation Engineer. Let him study your requirements . . . if your present insulations are correct, he'll tell you so. If not, he will prepare a complete recommendation showing the most efficient and economical types and thicknesses of insulation for every piece of equipment in your plant. Furthermore, he'll be glad to prove just how they will give you better heat or refrigeration control and save you money far beyond their cost.

Back of these engineers stands Johns-Manville's 80-year leadership in the development and manufacture of insulations . . . the largest, best equipped Thermal Insulation Laboratory in the world . . . and a complete line of insulating materials in block, brick, cement and pipe-covering form for every temperature, for every service condition.

Why not phone for a J-M Engineer today? His services are free . . . and you'll find one or more in every large city throughout the country. Or, for complete details on J-M Insulating Materials, write for Brochure IN-55A. Address Johns-Manville, 22 East 40th Street, New York, N. Y.

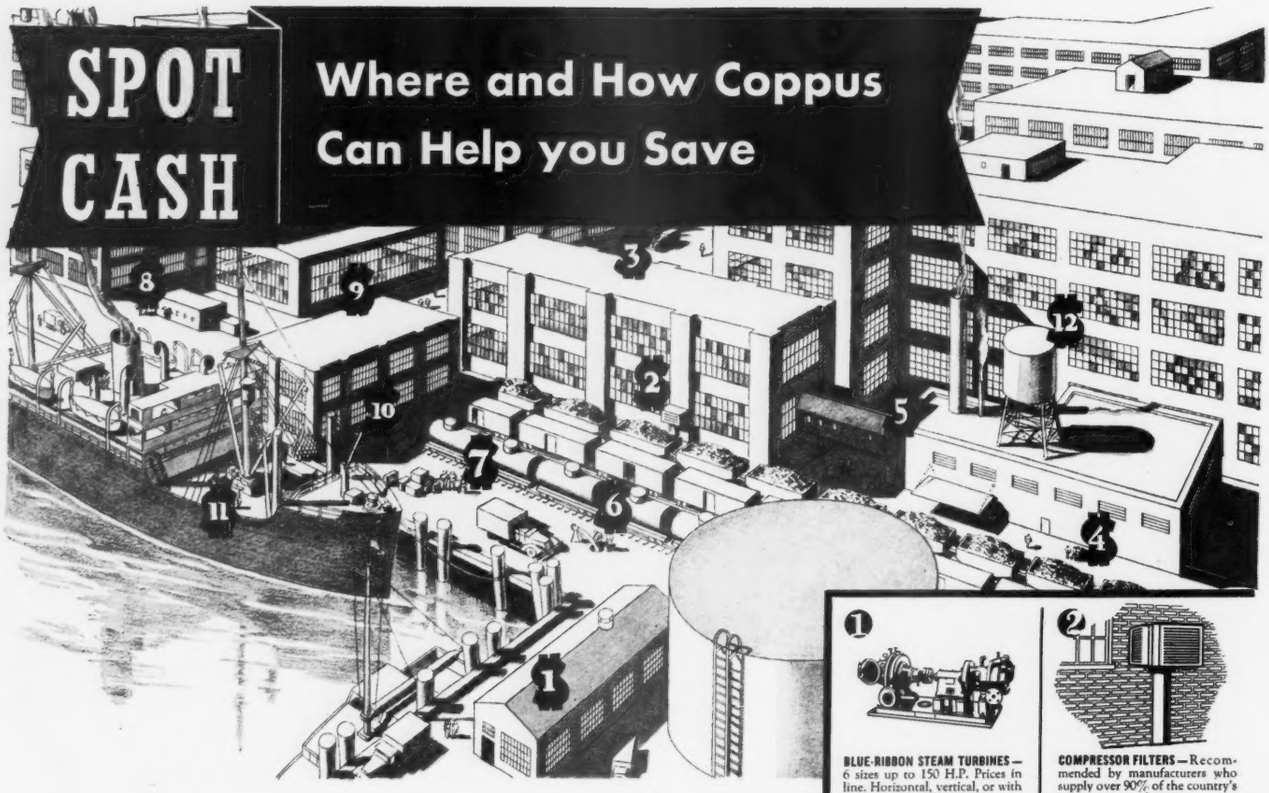
JM Johns-Manville

INDUSTRIAL INSULATIONS

for every temperature . . . for every service condition

SPOT CASH

Where and How Coppus Can Help you Save



In the spots above — and in many others throughout such plants — Coppus products for moving and cleaning air, turning steam into power, increasing fuel efficiency — are saving money for thousands of smart buying firms.

Those firms specify Coppus because they know that (1) Coppus turbines, gas burners, air filters, blowers, etc. are expertly *designed* for conditions characteristic of their industries, and (2) are *engineered* to fit individual requirements.

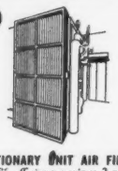
Get acquainted with the many products bearing the Coppus name. Check off below the free bulletins you want.

1

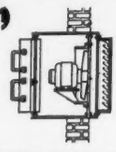
BLUE-RIBBON STEAM TURBINES—6 sizes up to 150 H.P. Prices in line. Horizontal, vertical, or with built-in speed reducers.

2

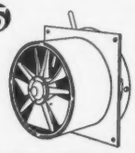
COMPRESSOR FILTERS—Recommended by manufacturers who supply over 90% of the country's compressors and engines.

3 

STATIONARY UNIT AIR FILTER—95.6% efficient against 2 micron-size silica dust. Highest U. S. commercial rating.

4 

VENTILATOR FILTERS—Combination ventilator-filter unit for laboratories, instrument assembly rooms, etc.

5 

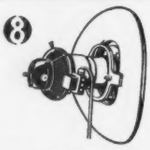
NATURAL GAS BURNERS—Coppus-Dennis Fanmix for industrial applications. Pinwheel action produces perfect gas-air mixture.

6

CABLE MANHOLE VENTILATORS—Fast ventilation of *any* confined space. Electric motor or gasoline engine driven.

7

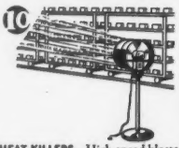
TANK AND TANK CAR VENTILATORS—Supply clean, cool air to men working. On cars — attachable to nipple if desired.

8 

BOILER MANHOLE BLOWERS & EXHAUSTERS—swift cooling and ventilating of boilers, tanks, retorts, etc.

9

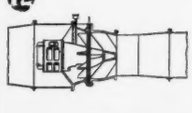
MANCOOLING FANS—Keep production up by keeping men cool. No stale air-recirculation. Air is *directed*.

10 

HEAT KILLERS—High speed blasts for cooling and drying furnaces, motors, generators, *products*, etc.

11

SHIPHOLD VENTILATORS—For exhausting welding fumes and other injurious gases from confined working spaces.

12 

VANO BLOWERS—Fitted to meet any special air problems where ordinary fans fail. They are *most* efficient.

COPPUS

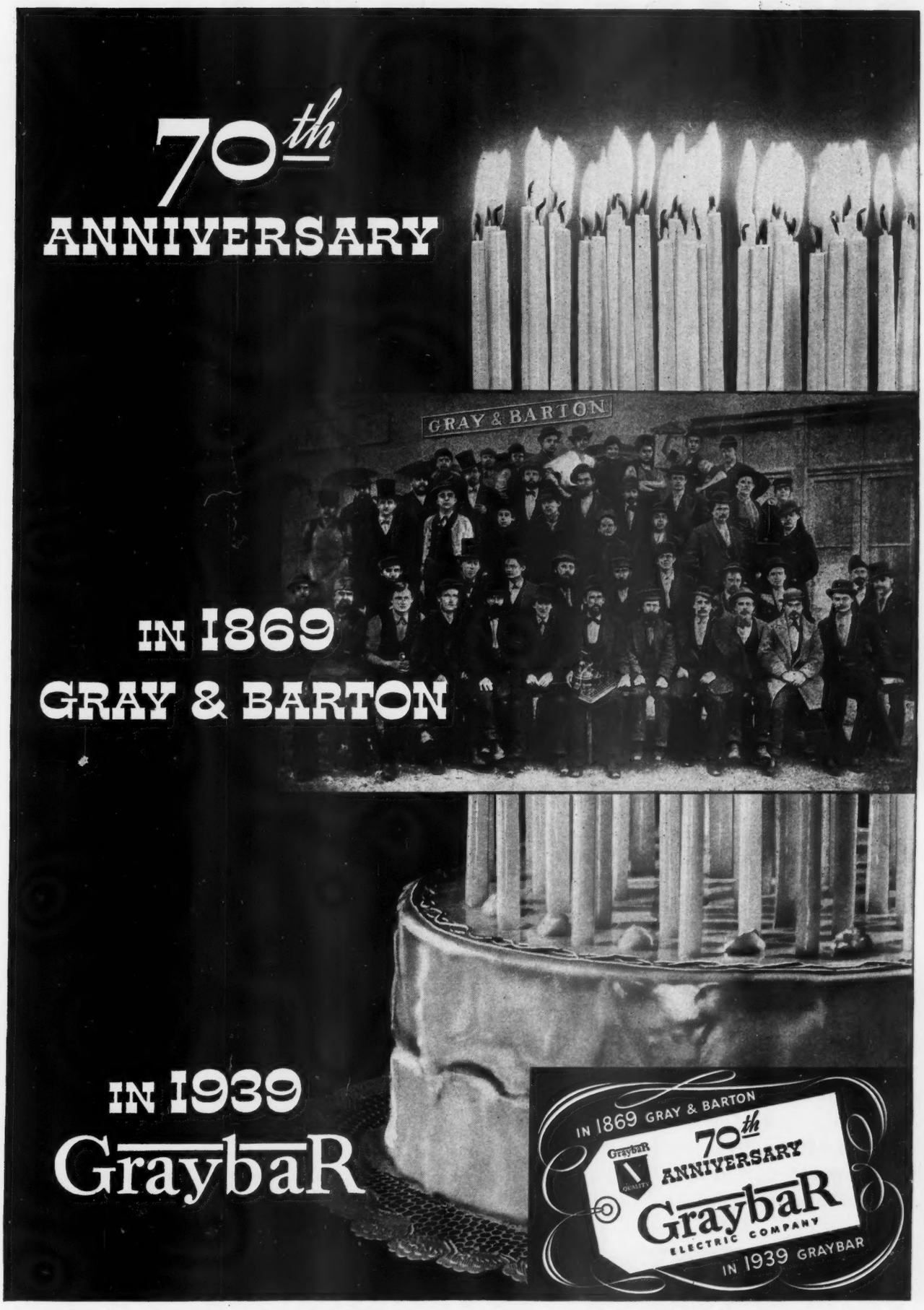
COPPUS ENGINEERING CORPORATION
375 Park Avenue, Worcester, Mass.

CHECK NUMBER OF APPLICATIONS

1 ☐	5 ☐	9 ☐
2 ☐	6 ☐	10 ☐
3 ☐	7 ☐	11 ☐
4 ☐	8 ☐	12 ☐

Mail in for free Bulletin

DESIGNED FOR YOUR INDUSTRY ——— ENGINEERED FOR YOU



OFFICES IN 83 PRINCIPAL CITIES FROM COAST TO COAST

DOLLARS-LOST IN A MIST

How Shell Engineers And Shell Products Are Helping You Fight The Battle For More Efficient Industrial Lubrication

EVER hear the story of the little lost dollar—lost in an oily mist? It can be heard in power plants, mills, factories and in the engine rooms of steamships, wherever the mist of steam-cylinder oils of unsuitable grade or inferior quality is wasting dollars instead of saving them. Its message may be translated into terms of excess oil consumption, low engine efficiency, increased maintenance costs—all reflecting reduced profits. You *can* do something about these mist-bound dollars!

For instance—Shell Engineers have developed Shell Wolco Oils—a series of great steam-cylinder lubricants. They are more readily atomized yet highly stable and heat resistant. And they deposit less undesirable residue than most cylinder oils on the market! If you are interested in saving dollars in power—dollars in maintenance—get in touch with your nearest Shell office today. A Shell representative will give you the complete story of this finest of steam-cylinder lubricants.

SHELL WOLCO OILS

IT'S GOOD BUSINESS *to use good* BRUSHES

SPECIFY Osborn Brushes

(Reading time: 29 seconds or less)

• The operation illustrated, at one time performed by hand, now performed by Osborn Brushes, roughens the flexible rubber discs of valve stems preparatory to vulcanizing them to inner tubes used in automobile tires.

To accomplish the desired results, careful consideration was given to select the type of Osborn Brush best suited to the conditions. Gauge of wire, diameter of brush and the correct operating speed were important factors.

After the right brush is determined, the customer is assured of maintaining uniformly good results by reordering duplicate Osborn Brushes made to uniformly high standards of quality and performance.

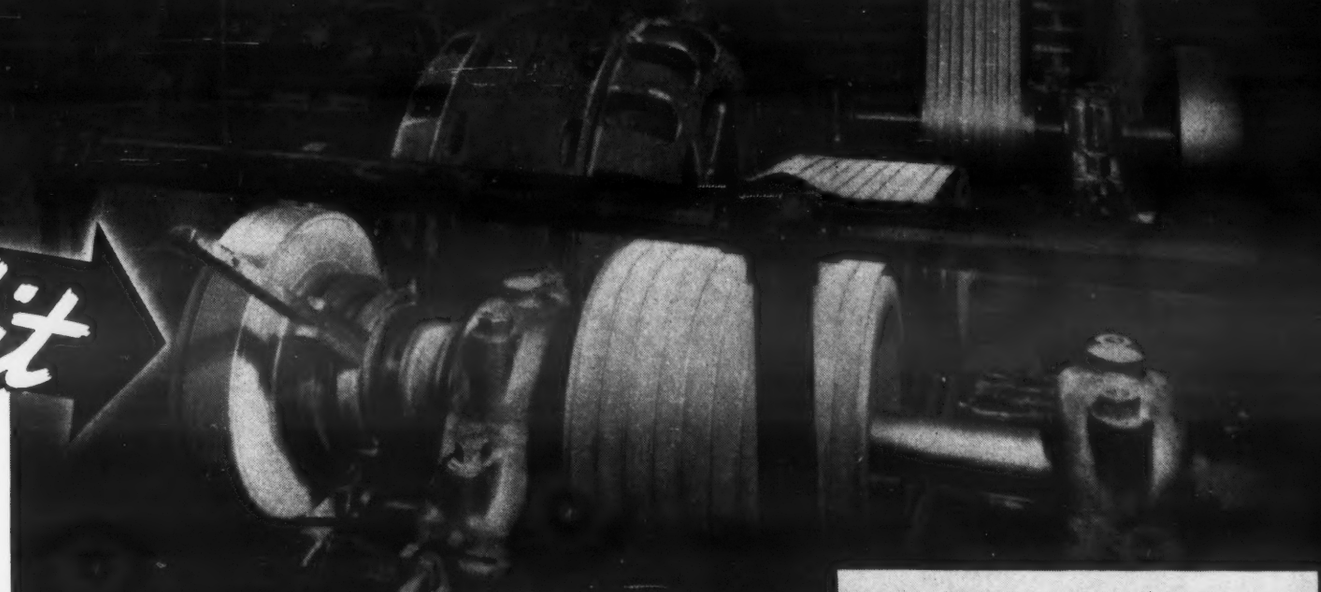
Osborn and the Osborn Distributor in your locality are prepared to help YOU select the right brushes to meet maintenance and production brush needs. *Ask about it!*

OSBORN

THE OSBORN MANUFACTURING COMPANY • 5401 HAMILTON AVENUE • CLEVELAND, OHIO

Think of Dodge . . . when planning a new plant . . . when adding a new department . . . when installing new machinery . . . when modernizing old equipment . . . when designing new products.

POINTED for Profit



● Last year industry suffered a "power-loss" of many millions of dollars.. Much of this can be avoided by executives pointing for profit .. during the early stages of planning the methods and equipment which are to control the movement of power in their plants . . . It's never too early to think of Dodge Drives . . specify them in your original plans . . for it is a proved fact that production profits are in the making between power generation and its travel to production machines . . . Dodge makes a complete line . . drives of proven performance and economy, but even more, Dodge represents a vast fund of practical experience gained during sixty years of service to industry which is reflected in its recommendations. There is a *right drive for every job* and the Dodge organization is ever ready to work with you to that end.

DODGE MANUFACTURING CORPORATION
MISHAWAKA, INDIANA, U. S. A.

The book "Pointing for Profit" just issued will suggest many profitable applications of Dodge drives.

DODGE
MISHAWAKA

There Is Added Value in the Name Dodge!

THE Right Drive FOR EVERY JOB

Think of Dodge

When planning a new plant — call on Dodge for unprejudiced power transmission recommendations backed by nearly sixty years experience.

When adding a new department — call on Dodge to recommend "the Right Drive for Every Job."

When buying new equipment — specify Dodge power drive and bearing units.

When modernizing old equipment — install standardized Dodge power drive and bearing units to save time, money and power.

When designing new products — use standardized Dodge power drive and bearing units to cut costs and improve performance.

izedDodge power drive and bearing units
to cut costs and improve performance.

BUSINESSES GROW
by plowing earnings back into new equipment —

★ *Below: Double deck Logan Roller Conveyors help put flow into machining operations. Upper deck serves machine operators with material, lower deck is storage reservoir for empty pans. No confusion, no cluttered aisles, just smooth, orderly production. Pivoted "gate section" affords passage thru conveyor.*

7
ECONOMIES
OF LOGAN CONVEYORS

1. SAVINGS IN EFFORT
2. SAVINGS IN TIME
3. SAVINGS IN SPACE
4. SAVINGS IN FAIR PACE-MAKING
5. SAVINGS IN INVENTORIES.
6. SAVINGS IN BREAKAGE
7. SAVINGS IN REDUCING LABOR TURNOVER (better working conditions)

Every Logan installation makes several of these economies. Frequently *all* are made. What are *your* possibilities?

IT'S the American way—forging ahead by plowing a fair share of earned capital back into new equipment.

And no field today promises more *tangible results* from the plowing—than that of materials handling. The close scrutiny of every movement of men and materials is disclosing to production men everywhere that there are bona fide possibilities for permanent economies—by doing it the Logan way.

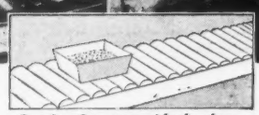
Have you turned the spotlight of attention on the *handling phase* of your operations? A critical appraisal may reveal cost-cutting opportunities that will quickly pay out on the modest conveyor investment necessary.

Here is a good *first move.* See the many conveyor installations shown in the new Logan Catalog 35. Your copy, now ready, will suggest similar applications in your plant. Write on your letterhead today.

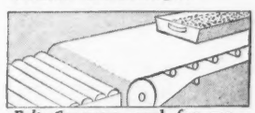
Catalog 35 shows what other plants are doing with Logan Conveyors. Write for your copy.

The new general catalog Number 35 covers virtually all types of industries. Special catalogs available on steel mill and foundry conveying. Logan field engineers located in principal cities.

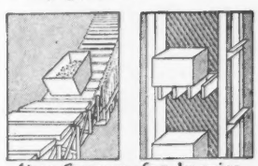
TYPES OF LOGAN EQUIPMENT



Gravity Conveyors—ideal where no power, except gravity itself, needed. See Catalog 35.

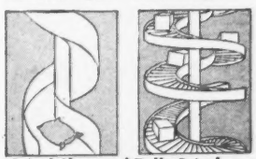


Belt Conveyors—used for medium duty power conveying. Many applications.



Apron Conveyors—for heavier duty power conveying. *Vertical Elevators*—lift and lower.

Live Rolls—permit stopping of package on power-operated roll conveyor. See catalog.



Spiral Chutes and *Roller Spirals*—"vertical" lowering by gravity.

Logan Conveyors

LOGAN CO., Inc., 510 Cabel Street, LOUISVILLE, KY.

"A Compressor motor gave us plenty of trouble

Says: —*Max Romonoff, Manager, Romonoff Electric Co., Toledo, Ohio.* "When we installed a switch and service for the air conditioning equipment in one of the F. W. Woolworth Company's Toledo stores, we found a 50 h.p., 220 volt reduced voltage start motor on the compressor. The heavy starting current on this motor gave us plenty trouble until we installed BUSS SUPER-LAG fuses.

Their long time-lag kept them from blowing when the motor started—and our needless shutdown troubles were over."

You Too, Can Reduce Needless Interruptions

Needless opening of fuses can generally be traced to one of two causes: a fuse-case design that permits the development of poor contact heating or a fuse-link design that doesn't give sufficient time-lag.

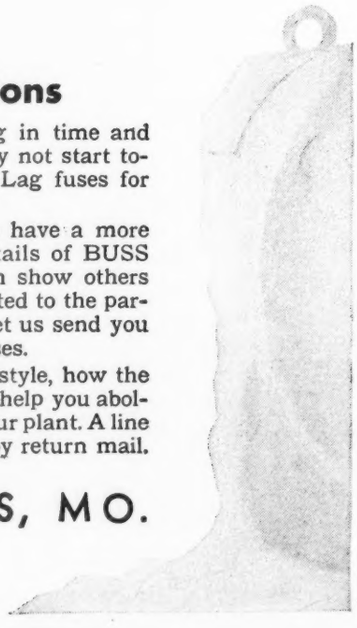
Years of engineering research and field and laboratory tests have produced in BUSS Super-Lag fuses a design that practically eliminates all needless opening from either of these causes.

Hence users of BUSS fuses enjoy a freedom from needless interruptions not possible with any other fuse.

Since this means a saving in time and money to your company, why not start today to specify BUSS Super-Lag fuses for all your fuse needs?

And if you would like to have a more complete picture of the details of BUSS construction so that you can show others just why BUSS fuses are suited to the particular needs of your plant, let us send you a copy of the RB book on fuses.

It shows, in quick reading style, how the design of the BUSS fuse can help you abolish senseless shutdowns in your plant. A line from you will bring a copy by return mail.



BUSSMANN MFG. CO. • ST. LOUIS, MO.
UNIVERSITY AT JEFFERSON
Division of McGraw-Electric Company

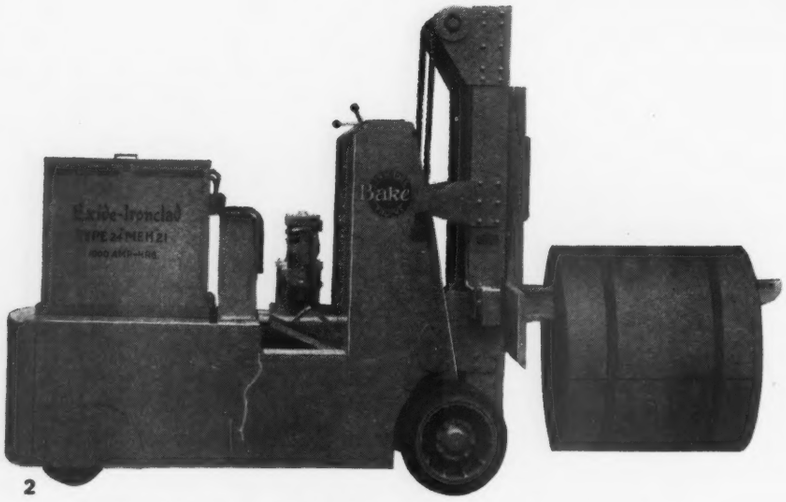
in a Woolworth Store *until we installed* . . . BUSS FUSES !

BUSS Super Lag FUSES

Go forward
. . . with Electrics and Exide-Ironclad

Exide
IRONCLAD
BATTERIES
With Exide **MIPOR** Separators
"MIPOR," Reg. U. S. Pat. Off.

1



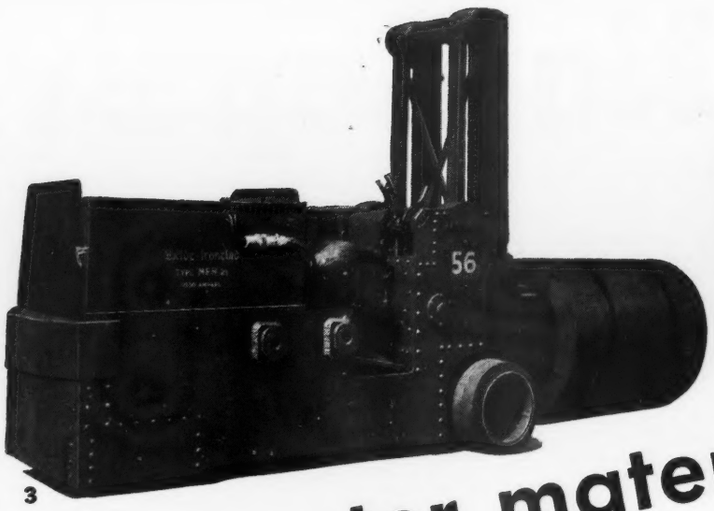
2

1—Truck made by The Yale & Towne Manufacturing Co.
2—Truck made by Baker-Raulang Company
3—Truck made by Automatic Transportation Co., Inc.
4—Truck made by The Elwell Parker Electric Company

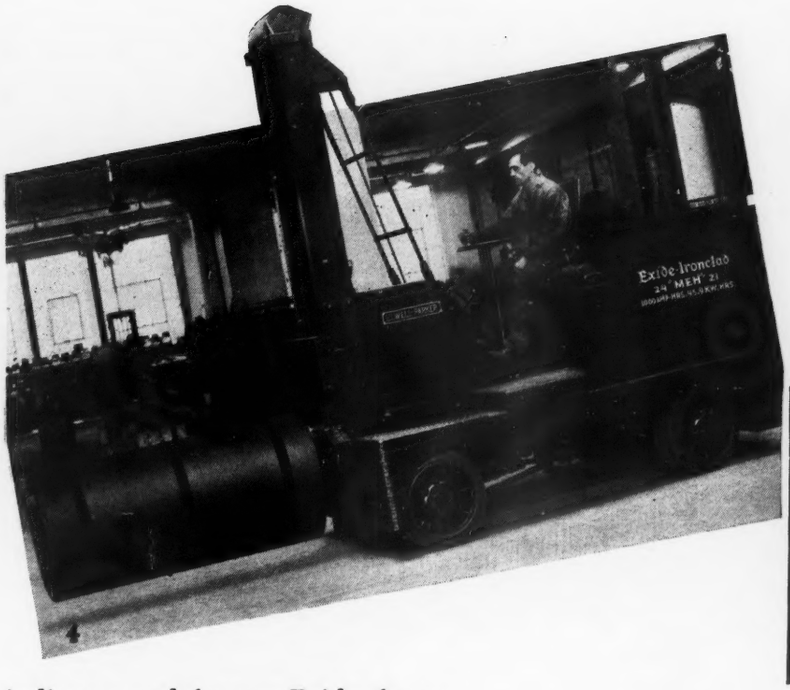
THE new year promises to be a great year for all industry—and for the electric industrial truck industry particularly, because these invaluable material handling units are broadening their value to users month by month.

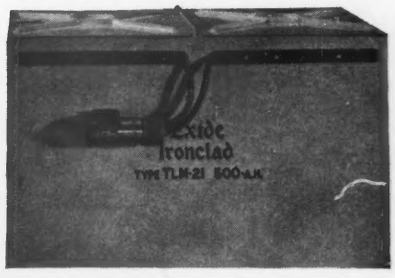
1939 will undoubtedly be a big year for battery propelled trucks, because—with the development of the new and greater MEH and FLM Exide-Ironclads in steel trays—batteries are now available for every truck, including the largest.

This means the same dependable and economical service day-in and day-out for all sizes of trucks on all jobs, no matter how large the truck or severe the service. And the development of a new Exide discharge



for greater material handling at lower cost!



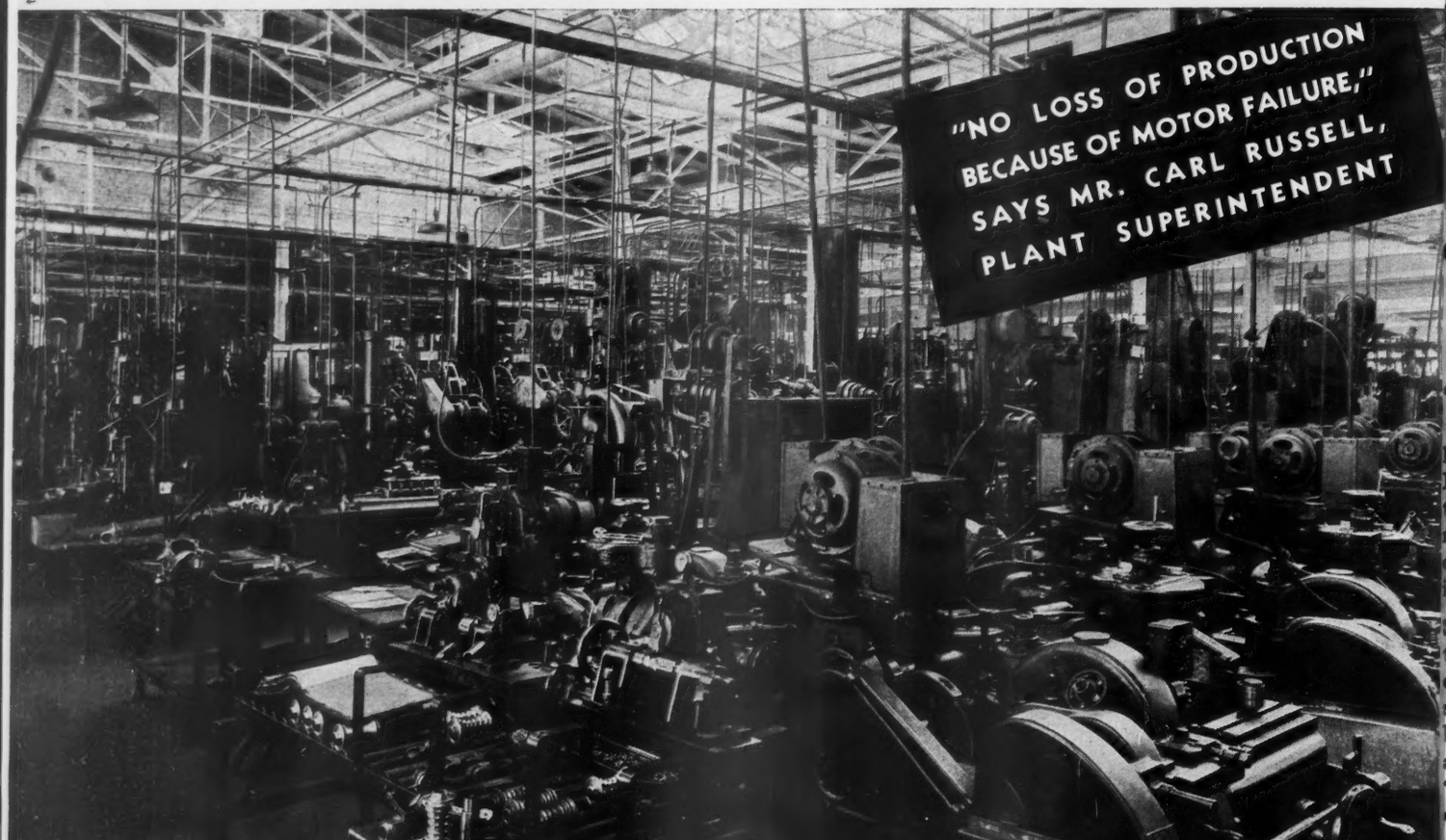


indicator, and the new Exide charge control unit assures better truck performance, less care and maintenance, and lower battery cost.

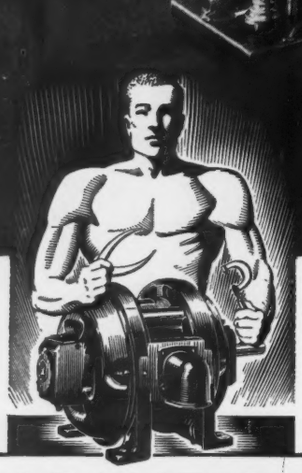
Start now to go forward with electric trucks powered by Exide-Ironclads and assure more dependable material handling at lower cost. Get in touch with us for full details.

THE ELECTRIC STORAGE BATTERY CO.
Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

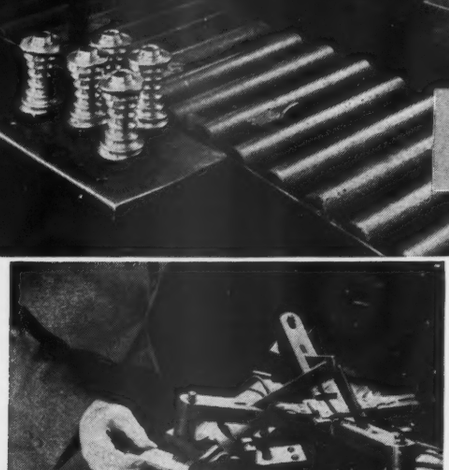
"Practically No Repair



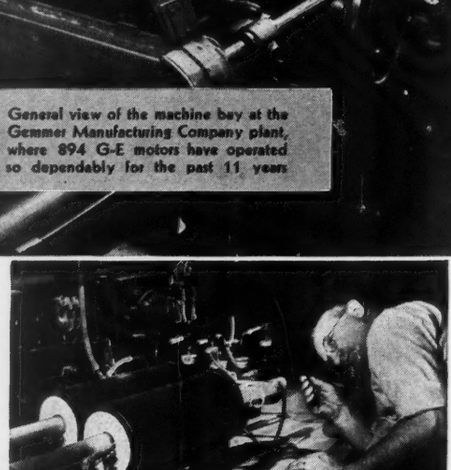
General view of the machine bay at the Gemmer Manufacturing Company plant, where 894 G-E motors have operated so dependably for the past 11 years



G-E MOTORS PASS ALL TESTS



EPSTEIN TEST—Silicon steel for rotor and stator laminations is given Epstein test to assure high permeability and low core loss



CARBON TEST—Steel and cast iron are tested for carbon content to make sure that they meet the high G-E physical-property standards

ACCURACY TEST—Skilled workmen, using precision instruments, inspect motor parts to make certain that they meet the rigid G-E specifications

STRENGTH TEST—Shaft and frame materials are constantly tested to destruction to make sure they meet rigid G-E physical-property standards

PERFORMANCE TEST—G-E motors save money—40 per cent in power costs was saved when this plant was modernized with G-E motors and control

r Costs" on 894 G-E Motors

At Gemmer Manufacturing Plant, Detroit

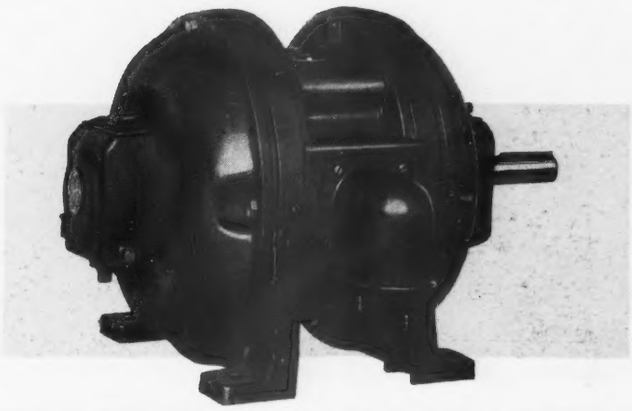
Another "FIELD TEST" of G-E Motor Performance

"GENERAL ELECTRIC MOTORS are second to none," says Mr. Tom O'Neill. And he should know, because he is Chief Electrician of the Gemmer Manufacturing Company—a company that manufactures complete steering-gear assemblies for the automotive industry, where loss of production is extremely costly and where electric motor performance is of vital importance.

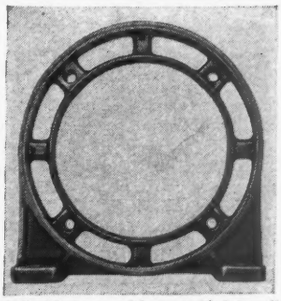
Since their installation, in 1927, 894 G-E motors, totalling more than 4500 horsepower, have operated dependably and economically. Mr. O'Neill further states, "During the ten years that these motors have been in service, they have run with a minimum of attention and practically no repair costs." He adds, "There is so little maintenance that it has been difficult to keep accurate figures."

G-E motors can pass such performance tests because they are rigidly tested at every step in their production. Tests of materials before the motors are made, and tests during their construction and after they are completed, are your assurance that when you buy a G-E motor, you are getting one which will give long life and low operating costs—one that will give you the performance you want.

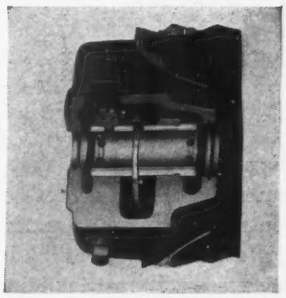
For complete information on all types and sizes, simply call your nearest
General Electric Office G-E Supply Corp. Branch G-E Motor Dealer
or write General Electric, Schenectady, N. Y.



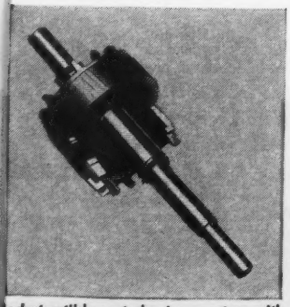
MORE FOR YOUR DOLLAR IN G-E MOTORS



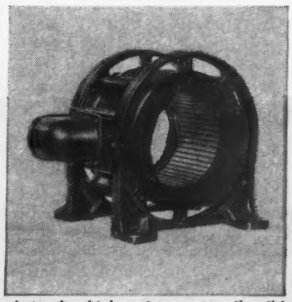
Malleable-iron end frames with integrally cast feet give G-E induction motors of 1 to 15 hp extra strength and rigidity



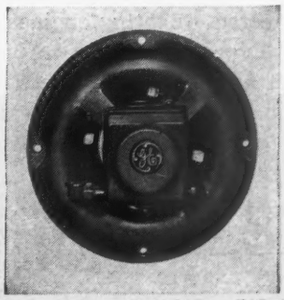
Sleeve bearings with an almost perfect performance record assure long life and low maintenance



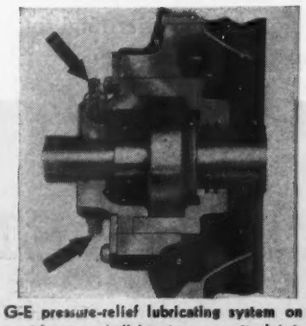
Indestructible cast-aluminum rotors with integrally cast fans are made from conductivity-tested aluminum



Insulation has high resistance to oil, mild acids and alkalis, moisture, abrasives, etc. Means long motor life and low upkeep costs



Strong, cast-iron end shields on all G-E induction motors provide accurate bearing alignment and uniform air gap



G-E pressure-relief lubricating system on cartridge-type ball bearings permits lubrication of motor without disassembly

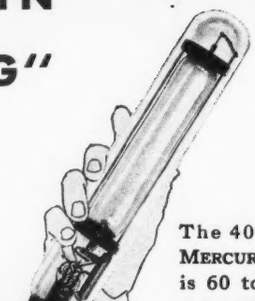
GENERAL ELECTRIC

020-370

No "EYE-TAX" Permitted!

. . . PLANT BANISHES PROFIT DRAIN WITH "ENGINEERED LIGHTING"

"Eye-Tax" is luxury that no industry can afford. Your Plant's most critical control devices are human eyes. They operate at slow speed in dim areas—and the average industrial lighting is about 5 foot candles. Dim indeed! "Eye-Tax" is inevitable. It steals the energy needed to keep eyes alert and product quality high. » » » Modern lighting, engineered to the job with General Electric Type H Lamps abolishes "Eye-Tax." It provides a truly economical means of obtaining the necessary higher levels of illumination. You get higher light output for the same cost of energy. When blended with incandescent light, these mercury lamps provide illumination which simulates and blends well with daylight. » » » Have a lighting specialist show you how to banish "Eye-Tax" with lighting engineered to fit the job. For complete information, write to the General Electric Vapor Lamp Company at either address given below.



The 400-Watt MERCURY Lamp is 60 to 140% more efficient than other available light sources.

Order your auxiliary devices which were designed especially for this lamp from the General Electric Vapor Lamp Company.

GENERAL ELECTRIC

926H

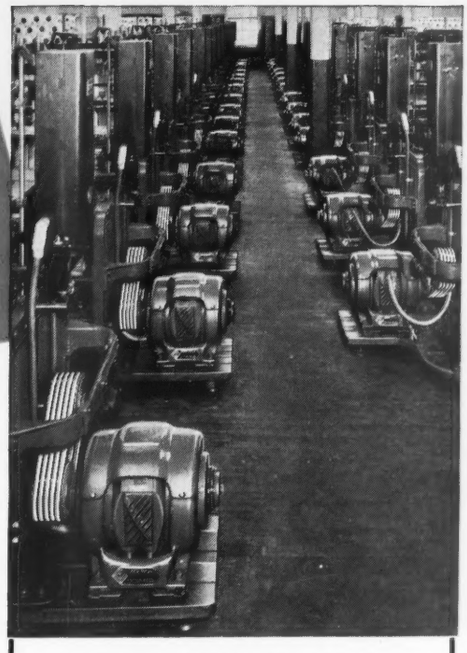
General Electric Vapor Lamp Co.
815 Adams Street, Hoboken, N. J.

Incandescent Lamp Department
Dept. 165, Nela Park, Cleveland, Ohio

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

HOW A DRIVE REVOLUTIONIZED AN INDUSTRY!

Read the Amazing Story of How the Texrope Drive Cut Average Drive Maintenance Costs on Spinning Frames to $1.05 per Year . . . Saved Thousands of Dollars in the Textile Industry! Find out How Allis-Chalmers Equipment . . . the Equipment that Pays for Itself . . . Can Save You Money!



DRIVING SPINNING FRAMES in a large southern textile mill are these Allis-Chalmers "Quick-Clean" Motors and Texrope Drives.

● They brought a tough job to Allis-Chalmers . . . those engineers from a large southern textile mill. They had trouble . . . plenty of it. They had drives that slipped or jerked, snapping fragile yarn on spinning frames . . . spattering oil on processed goods.

Production costs were running rampant. Spinning frames had to be stopped while repairs were made . . . while broken threads were re-tied. Oil-damaged goods had to be sold for a fraction of their actual cost . . . far below standard market values.

They came to Allis-Chalmers. And no wonder! For they knew that Allis-Chalmers, with an engineering background extending over half a century, could help them. Allis-Chalmers did help them . . . and in doing so, revolutionized an entire industry!

For out of this engineering problem came the Texrope Drive. And because the Texrope Drive did not slip . . . did not jerk . . . did not break the yarn on the frames, production costs were cut to an absolute minimum throughout the textile industry. Actually, drive maintenance costs on spinning frames were reduced to the sensationally low average of $1.05 per year!

From the Textile Industry to All Industry!

All this happened in the 1920's. And today throughout all industry . . . all over the world . . . the Texrope Drive is setting amazing records in cutting costs, in beating power waste. Texrope Drives have paid for themselves, hundreds of times over, wherever they are installed!

This true case history is not an unusual occurrence at Allis-Chalmers. It's another engineering solution to the constant problems that confront industry . . . another noteworthy addition to the Allis-Chalmers line of equipment that pays for itself.

Get the complete details on the way Allis-Chalmers can put 90 years of engineering experience to work for you. Get the facts. In the District Office near you, there's an Allis-Chalmers engineer who can show you how to make your plant a bigger money-maker . . . with the equipment that pays for itself!

Vari-Pitch Speed Changers • Texrope V-Belts • Duro-Brace Texsteel Sheaves • Vari-Pitch Sheaves • Standard Cast Iron Sheaves • Adjustable Pitch Diameter Texsteel Sheaves • 2-3-4 Combination Sheaves • Straitline Automatic Motor Bases • Oil Field Drilling Rigs

Belts by Goodrich

TEXROPE DIVISION

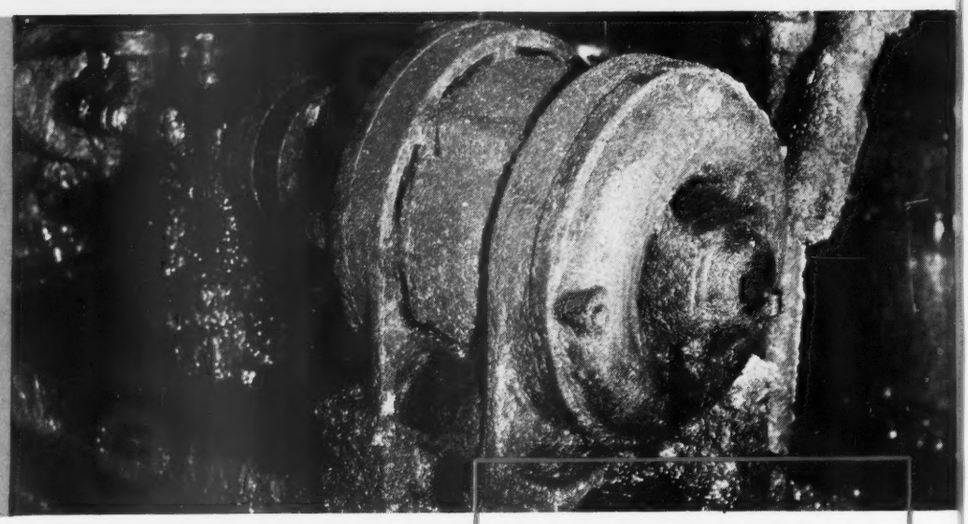
ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

5 YEARS ON SUICIDE ROW!

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

Read the Record-Breaking Performance Story of an Allis-Chalmers Lo-Maintenance Motor! Find Out How It Beat Conditions that "Cracked-Up" Ordinary Motors in 60 to 90 Days! Get the Facts on Full-Measure Protection in Lo-Maintenance Motors..On the Savings It Means to You!



NOT A PRETTY PICTURE! But this Lo-Maintenance Motor was running perfectly five years after it was installed in this chemical plant! The full measure protection built into every Allis-Chalmers motor beat operating conditions that wrecked other motors in 60 to 90 days!

When operating conditions are tough . . . when motors "crack-up" in 60 to 90 days . . . that's a challenge to every manufacturer who makes motors! And when an Allis-Chalmers Lo-Maintenance Motor stands up for five years under those same conditions. . . without running up costs . . . without breaking down . . . that's a story you'll want to know!

This all happened in the factory of a big chemical company . . . and in the part of their plant where chlorine is used in processing products, they had motor trouble . . . plenty of it! For chlorine fumes seeped into the motors . . . ate off winding insulation . . . wrecked them nearly as fast as they were installed! No wonder they called it "suicide row"!

Then they installed the Allis-Chalmers Lo-Maintenance Motor that broke every record!

Chlorine gas . . . moisture . . . heat couldn't stop it! And at the end of five years' time that Lo-Maintenance Motor was running as perfectly as the day it was installed!

Why was an Allis-Chalmers Lo-Maintenance Motor able to beat adverse operating conditions? Why was it able to stand up 20 times longer than ordinary motors? The answer is the Full-Measure Protection built into every Allis-Chalmers Lo-Maintenance Motor!

Learn What Allis-Chalmers Can Do For You!

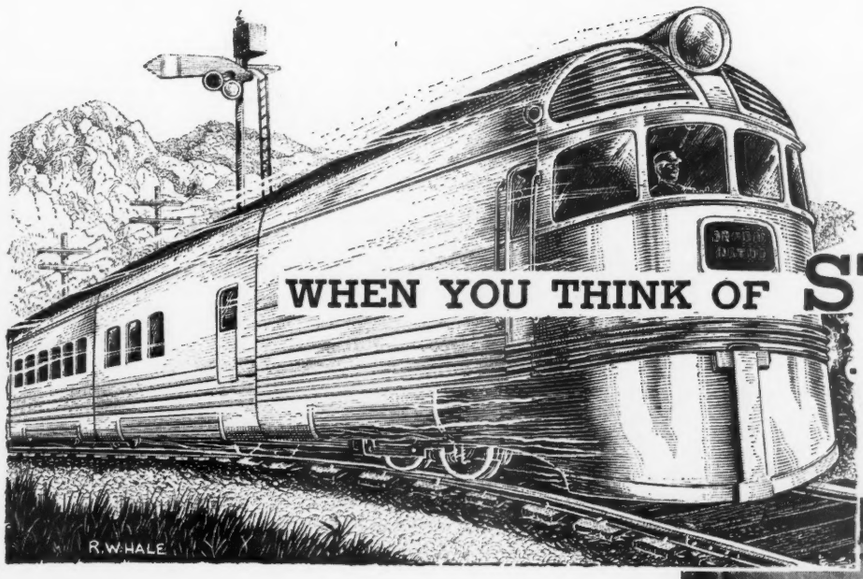
When you buy a Lo-Maintenance Motor you get more than a motor that delivers just a rated horsepower. You get a motor that has built into it the results of Allis-Chalmers' 90 years of advancing with industry . . . of making motors to meet the rigid requirements of their own famous line of heavy duty industrial equipment.

High carbon steel frame . . . indestructible rotor and stator . . . husky all-around construction with no skimping on materials . . . add them together and you get a motor that's built for long life . . . without running up costly repair bills!

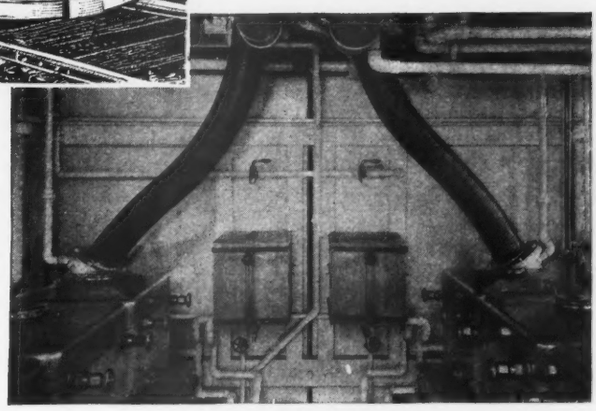
Get the Full-Measure story of Lo-Maintenance Motors. Call the nearest Allis-Chalmers District Office or write direct to Allis-Chalmers. Find out how you can cut maintenance . . . keep production steady . . . with Allis-Chalmers Lo-Maintenance Motors!

MOTORS FOR ALL APPLICATIONS FROM ½ HORSEPOWER AND UP

ELECTRICAL DIVISION
ALLIS-CHALMERS
MILWAUKEE·WISCONSIN



WHEN YOU THINK OF STRENGTH . . . YOU THINK OF METAL

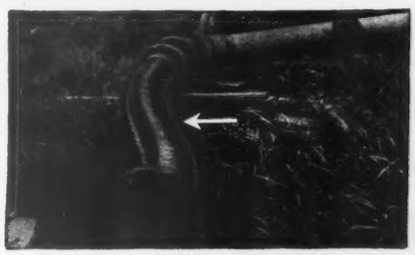


METAL *Strength in* FLEXIBLE HOSE and TUBING can help you to cut costs . . . and make better products

These Diesel exhausts have seen 10 years continuous service. They are fume tight, resistant to high temperatures and exhaust gases, and flexible to absorb vibration.

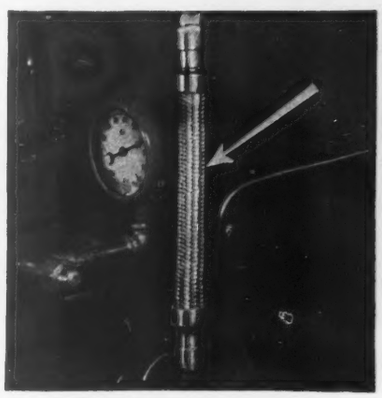
When design engineers sought the ideal balance of safe strength with light weight that made development of modern "streamliners" possible, they naturally found their answer in new METAL alloys.

Similarly, wherever flexible hose or tubing finds application in your plant, or as an integral part of the equipment you manufacture, the many specialized types of Flexible METAL Hose and Tubing offer you the obvious advantages of METAL strength . . . plus true flexibility, long life, ability to withstand heat, pressure, vacuum and the destructive action of many gases and liquids.



This 10" Flexible METAL Hose section (installed 13 years ago) absorbs vibration, prevents breaks in this gasoline and oil tanker unloading line. Previously the line frequently broke at this point.

Just how these important modern developments are serving industry in many fields . . . and how they can help you to reduce operating and manufacturing costs . . . is discussed fully in our newly published "Fact Book". We shall be glad to send your copy . . . without obligation . . . on request.



Flexible METAL Tube vibration absorbers have proved a complete solution to the problem of isolating noise on air conditioning and refrigeration equipment.

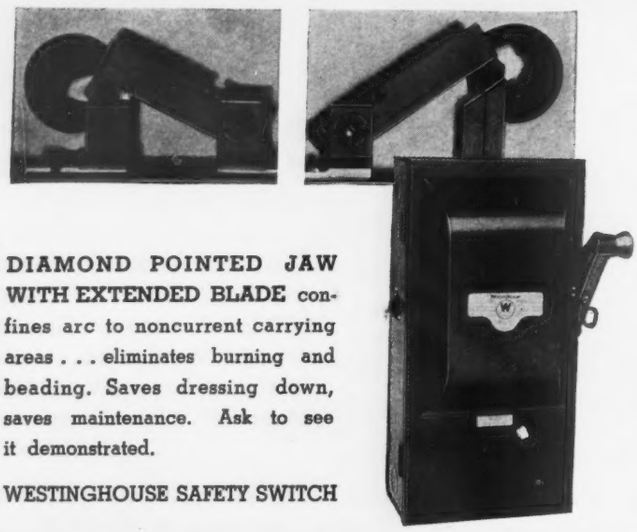
FLEXIBLE METAL HOSE AND TUBING

• INSTITUTE •

150 BROADWAY, NEW YORK, N.Y.

KEEP ABREAST OF NEW DEVELOPMENTS

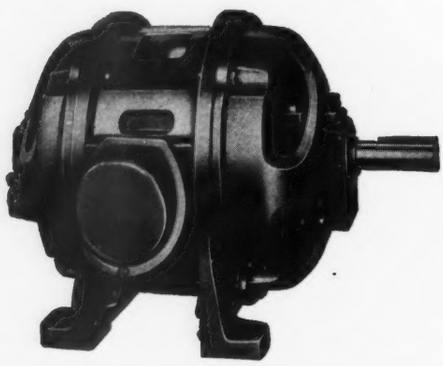
IN WESTINGHOUSE MOTORS AND CONTROL



DIAMOND POINTED JAW WITH EXTENDED BLADE confines arc to noncurrent carrying areas . . . eliminates burning and beading. Saves dressing down, saves maintenance. Ask to see it demonstrated.

WESTINGHOUSE SAFETY SWITCH

EXTRA STRENGTH AT NO EXTRA COST IN WESTINGHOUSE MOTORS . . . Extra electric strength in Tuffernell Insulation, extra mechanical strength in rigid one piece frames. Ball or sleeve bearings free from lubrication grief.



ALL NECESSARY CONTROL AND PROTECTION IN ONE EASILY INSTALLED PACKAGE . . . The Westinghouse Combination Linestarter . . . Costs less to install . . . saves wiring, conduit, labor . . . simplifies inspection.

★ ★ ★

WESTINGHOUSE COMBINATION LINESTARTER

HIGH SPEED MOTOR EFFICIENCY FOR SLOW SPEED MACHINES . . . Now you can get the horsepower you want at the rpm. of the driven machine. Saves cost of separate mechanical units . . . simplifies installation, saves maintenance of belts, pulleys, sprockets or chain.

Westinghouse

W
WESTINGHOUSE ELECTRIC

Saves Two Thirds in Installation Cost

. . . AND GETS MODERN, COMPACT ASSEMBLY OF MOTOR AND CONTROL

A manufacturer in Pennsylvania planned to revamp his production to eliminate lifting and handling of parts — ironing out the wrinkles in the production line. Lineshafts were centered in the building and to hook these straightening machines to the lineshafts meant added expense.

Westinghouse gearmotors and Combination Linestarter control solved the problem . . . at one third of this estimated expense. Each machine is individually driven and controlled, and located independent of any other drive.

Note the simplicity and compactness of the gearmotor application. It delivers the required horsepower at slow speed with 98% of the efficiency the motor would have at standard speed.

Note, too, how pushbutton start and stop is at the operator's finger tips — how in one unit, mounted on the machine the Combination Linestarter provides fuseless circuit protection, undervoltage protection, motor running protection and magnetic starter.

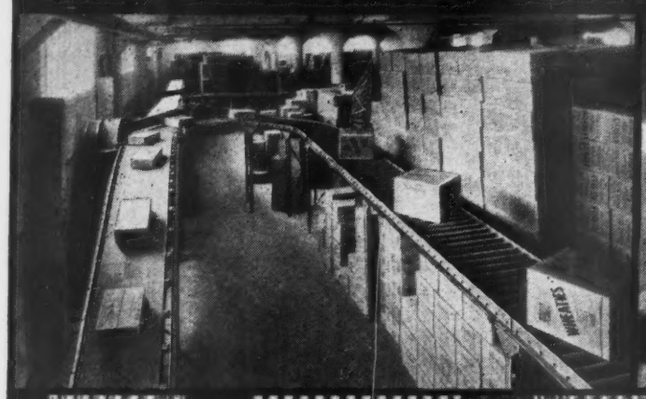
Let Westinghouse help you modernize your motor and control the economical way. There is a Westinghouse electrical wholesaler, motor dealer, industrial agent or district office in all principal cities, ready to give you the benefit of Westinghouse research, engineering, and application. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

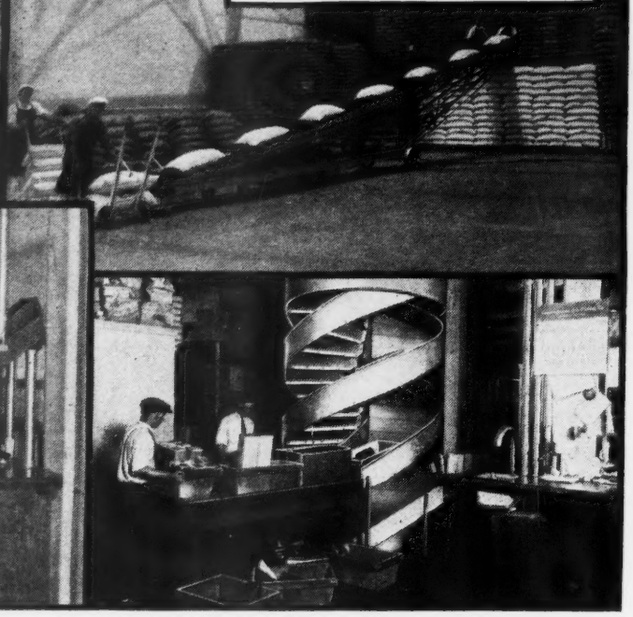
J-90149

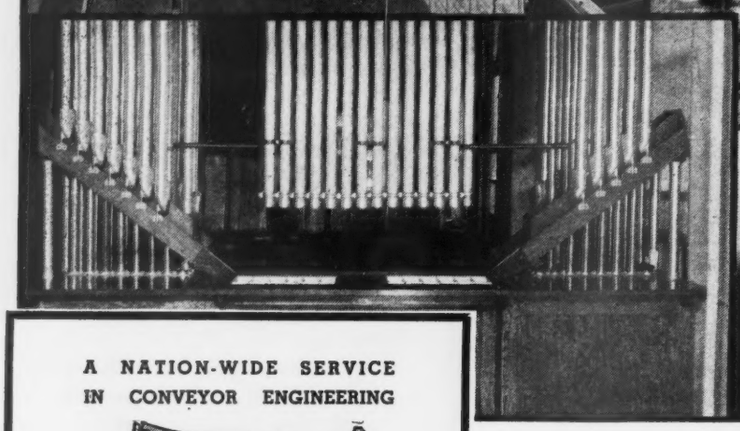
Motors and Control

More than 50
DIFFERENT INDUSTRIES
SLASH COSTS
with STANDARD CONVEYORS

- Paper
- Newspaper
- Distillers, Brewers and Soft Drink Bottling
- Paint and Soap
- Chemical Product
- Oil Refineries
- Wholesale Grocers and Food
- Meat Packing
- Bakeries and Flour Mills
- Department Stores and Mail Order
- Wholesale Drug and Hardware
- Textile
- Rubber
- Docks and Warehouses
- Steel Mills and Foundries
- Machine Shop Assembly Plants—Automobiles, Stoves, etc.
- Electrical Appliance
- Hospitals, Insurance Company Offices, Institutions
- Lumber, Packing Plants, Furniture and Frame
- Dairies and Cigarette







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For more than thirty years the Standard Conveyor Company has been building pneumatic tubes, power, chute and gravity conveyors for America's leading industrial firms.

This extensive varied experience record eminently qualifies the Standard Conveyor Engineer to render valuable engineering counsel. Send for Catalog FM-1, a valuable reference book on handling methods.

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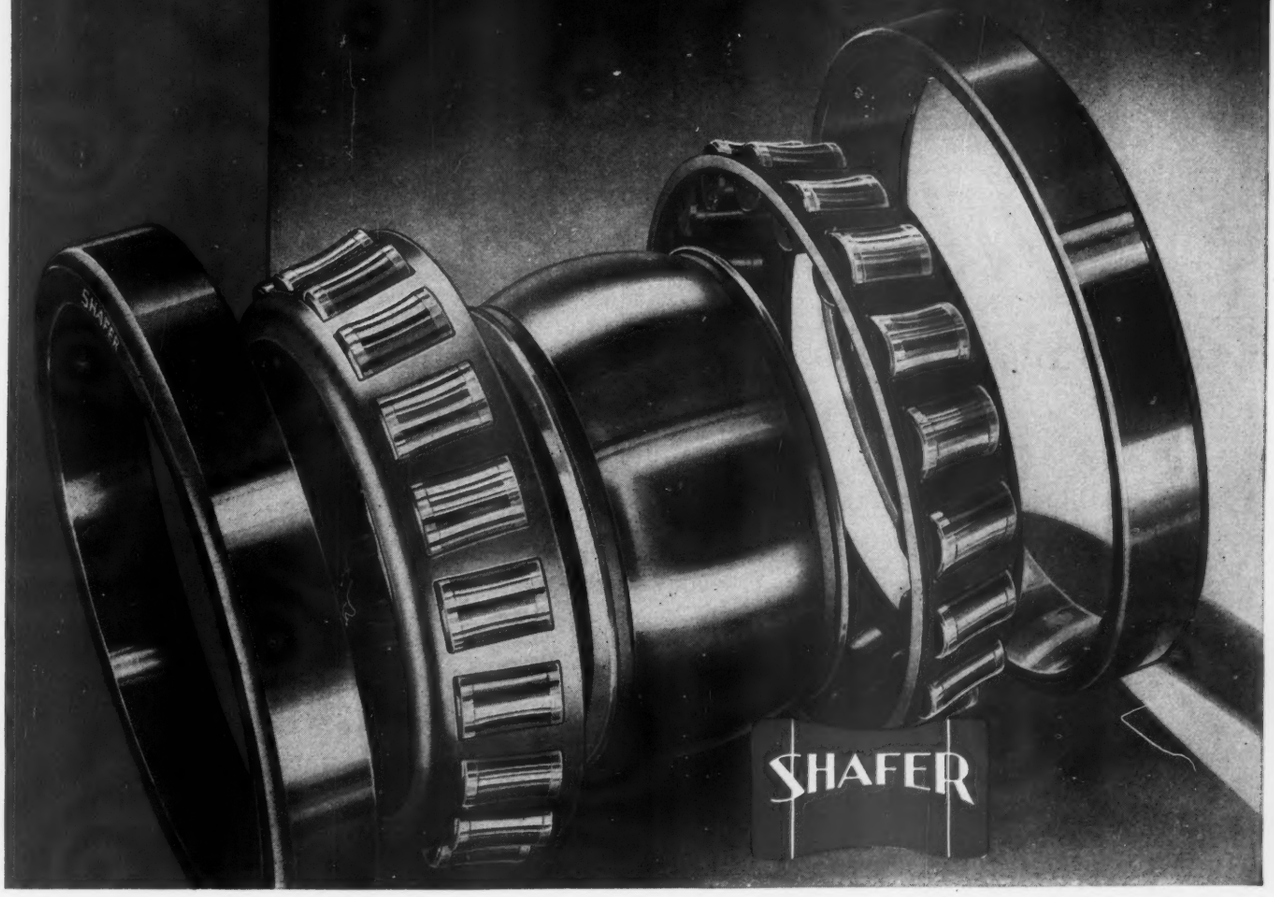

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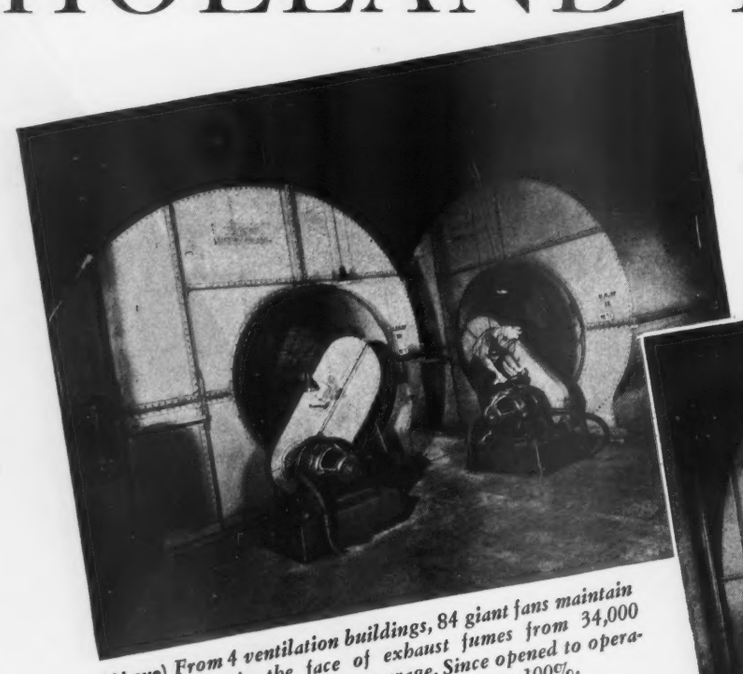

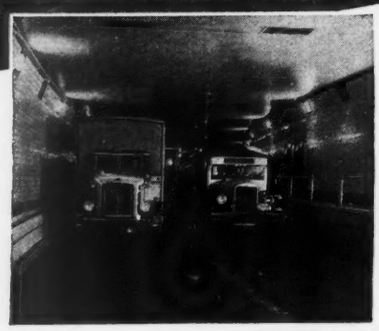

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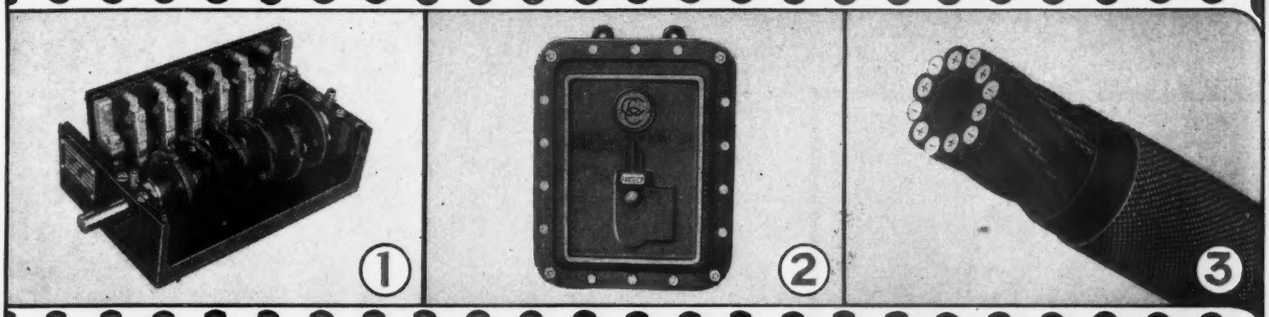

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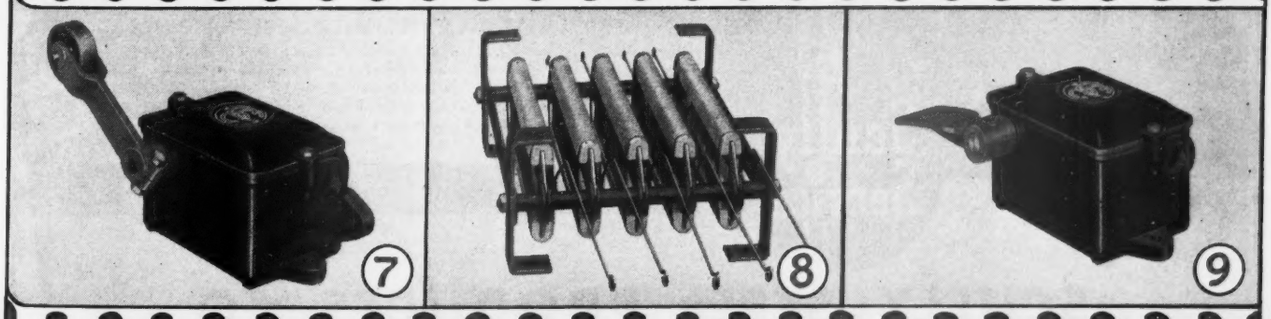
2. Bulletin 6013 Across-the-Line Explosion Proof Starter
3. Bulletin 7777 Clark Kickless Cable (Rees Patent)
4. Bulletin 5840 Primary Resistor Starter, Oil Immersed

5. Bulletin 6155 Wound Rotor Speed Regulator
6. Bulletin 6020 Across-the-Line Explosion Proof Starter
7. Bulletin 102 Type HL Hatchway Limit Switch
8. Bulletin 113 Ventwound Resistor • 9. Bulletin 101 Type FR Foot Switch



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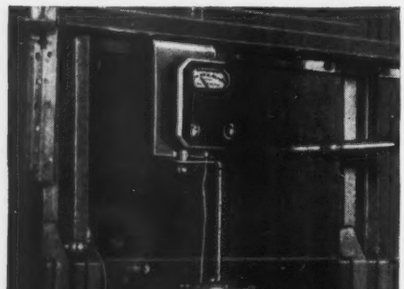

• Here is a section of a vapor-spray-vapor type degreaser showing Taylor Air-Operated Temperature Control. Taylor Self-Acting Temperature Control, not shown here, is also used. Pressure Control guards against excessive boiling of the solvent and spilling of vapors over the top; and automatically maintains the correct vapor level with respect to the condensing chamber. It cuts down the supply of steam, keeping the level constant and saves solvent.

An example of how a Fulscope Recording Controller paid for itself ... and did a better job of degreasing

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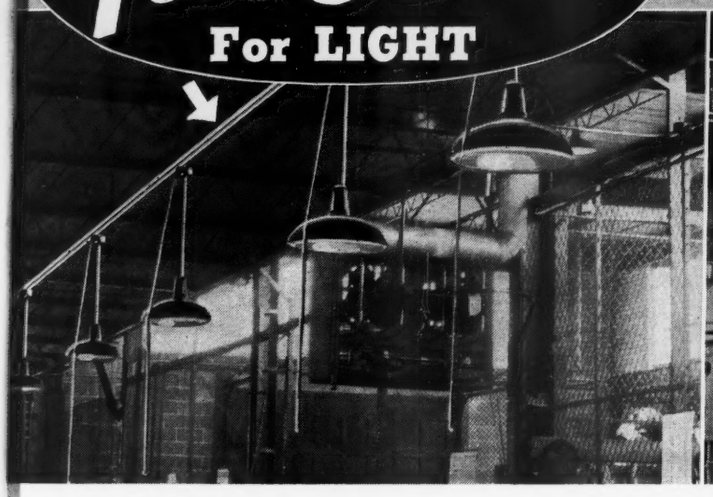

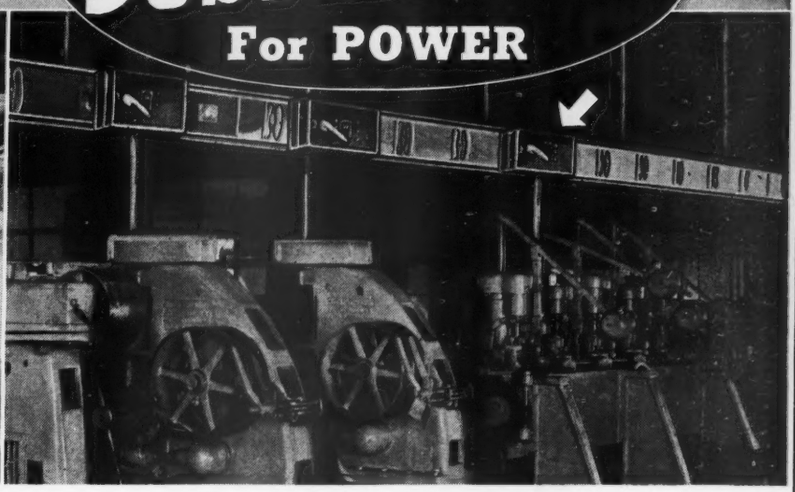

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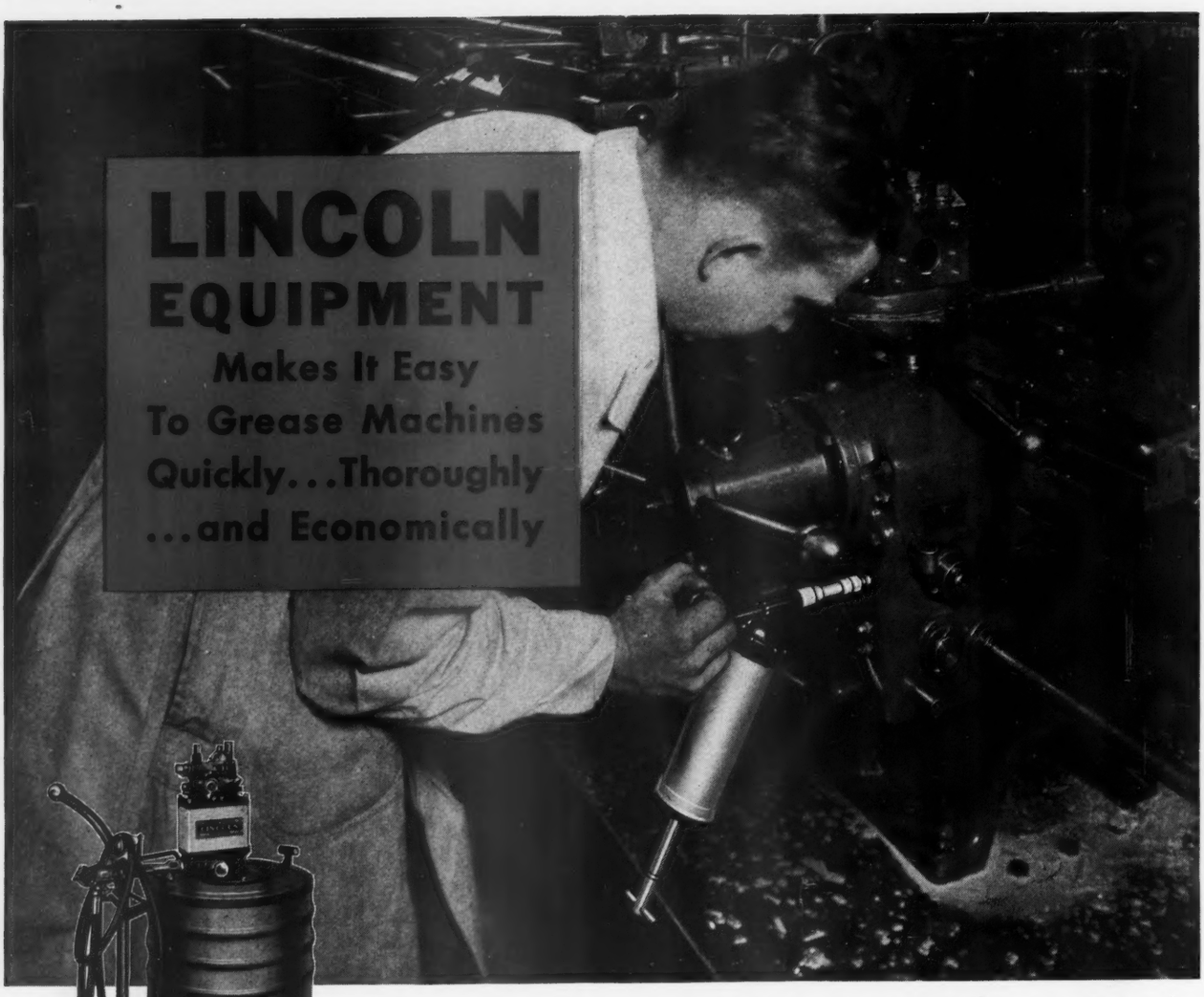
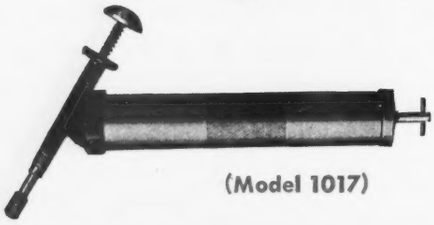


(Illustration above shows Model 1016 Utility Gun being used to grease lathe)

(Model 309)

● Lincoln makes a wide range of equipment for the most efficient application of grease lubricants. The line is complete. It includes small KLEENSEAL Grease Guns such as the Model 1016 shown above, larger units of the type described below, and even larger units which are electrically operated and dispense lubricant direct from original 400-lb. drum.

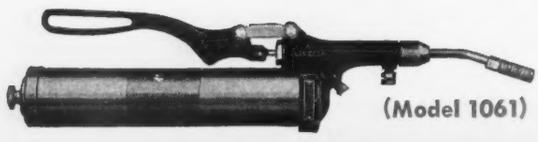
MODEL 309 TWIN CYLINDER AIR-LINE LUBRIGUN (shown at left) dispenses lubricant directly from an original 100-lb. drum. This unit is capable of handling semi-solid oils as well as viscous and fibrous greases. Mounted on a truck with 12″ rear wheels and swivel front casters. Easily pushed from job to job.



(Model 1017)

MODEL 1017 (shown at left) is one of several models of KLEENSEAL Grease Guns. All models of this type provide a fast, clean method of lubricating machinery equipped with KLEENSEAL, Zerk or hydraulic fittings. Model 1017 has 14-oz. capacity. Maximum pressure—5,000 lbs. . . . Models are also available in 3½ . . . 5¼ . . . 9 . . . and 18-oz. capacity.

LEVER-TYPE GUNS are available in both high pressure and volume types, with attachments for all types of fittings. Model 1061 (illustrated) handles all types of lubricants and develops pressures up to 10,000 lbs. . . . Capacity 18 oz.



(Model 1061)

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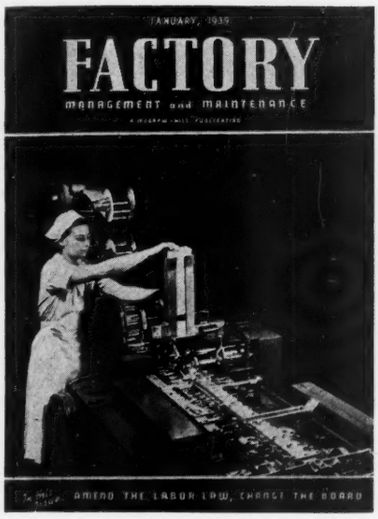

FACTORY's new four-color cover is in line with long-time policy of giving readers the best business paper possible. This month's full-color photograph of the girl at the film-packaging machine is not only handsome but also newsworthy because it was taken with the new Eastman Professional Kodachrome Type B Film, made commercially available only a few weeks ago. Also, a brand-new cost-halving process, perfected within the month by a member of the McGraw-Hill organization was used in making the color plates.

■

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FACTORY

MANAGEMENT and MAINTENANCE

JANUARY, 1939

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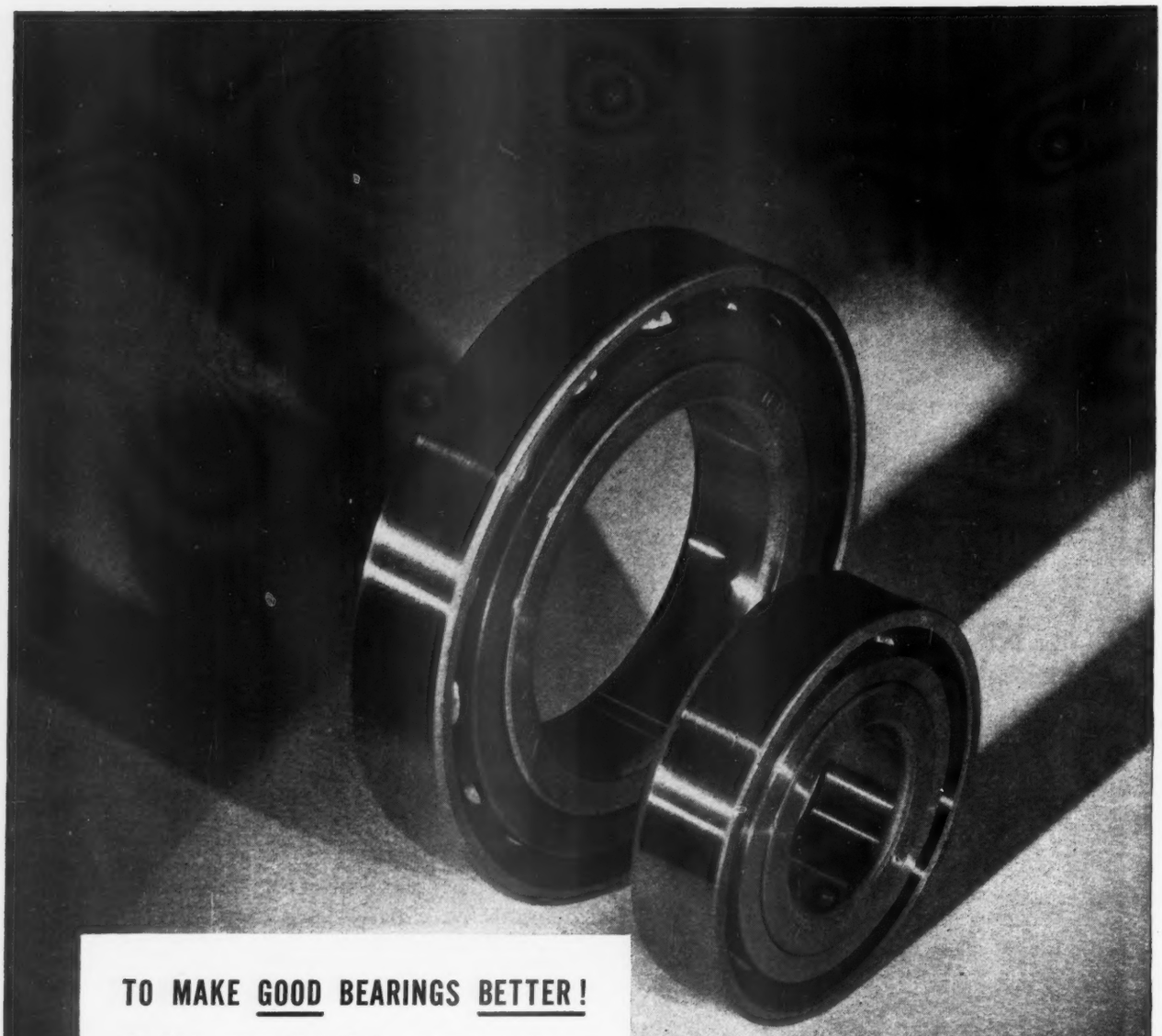

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FACTORY
MANAGEMENT and MAINTENANCE

L. C. MORROW, *EDITOR*

WAGNER ACT AMENDMENT
Is Congress' Biggest Job

IF THE NEW CONGRESS serves well, it will move at once to amend the Wagner labor law. The time for action has come. A generous trial period has elapsed, and the law has been found wanting.

What it seemed obvious would happen, has happened. Industrial disputes have multiplied. Organized labor has run riot. The Labor Board has exercised a dictatorship over industry. Workers have had to accept representation by coercion rather than by free choice. Higher labor costs have forced prices up. Sales have dropped. Jobs have dropped with them. Recovery has been delayed.

FACTORY warned of these results before the act was passed. Has seen its predictions come true. Has, time after time, stood for amendment. Is firmly convinced that the law must be changed in the interest of our national economy.

Are FACTORY'S convictions also the convictions of industrial management? What are the opinions of the men in daily contact with the operation of the law? The men who actually operate plants? The men who are responsible for the production of those goods and services without which there can be no wages for labor, no purchasing power for anyone, no national income?

The opinions of these men are summarized in the following pages. They were secured by letter ballot in FACTORY'S poll of a cross-section of the manufacturing industries. Here, for the first time, is industrial management's collective opinion. It comes from 1,500 men engaged in plant operation, from all the manufacturing industries, from all sections of the country.

Thirty-two questions for "Yes or No" answers constituted the ballot. No questions were so framed as to influence the vote. Every ballot required the thoughtful consideration of the voter. No individual and no company names were requested, but it was asked that industries and titles of individuals be specified.

We asked, of course, if the law should be amended, repealed, or left unchanged. We listed the major specific amendments that have been proposed, and asked for a vote on them. We asked whether or not the act has benefited industry, labor, or the public.

But we asked, also, if there is a need for a basic law to safeguard the organizing rights of labor. And we asked whether or not the voter, if the appointive power were his, would continue the service on the Labor Board of the three incumbents.

You will want to study the details of this balloting by management, because you have never had an opportunity to know management's collective opinion. Other polls have given the opinion of labor and the opinion of the general public. Individuals engaged in management have spoken publicly. But here is the *collective* voice of the management of industry.

It is enough to say here that by this ballot FACTORY is supported in its stand for amendment. The voting confirms our belief that the law is not workable; makes for industrial conflict, not harmony; should be amended in many respects, without further delay.

L. C. Morrow

"Amend the Labor Law,

Says industrial plant management in Factory's nationwide survey. Industry recognizes the need for a basic labor law, proposes amendment rather than repeal, demands new board

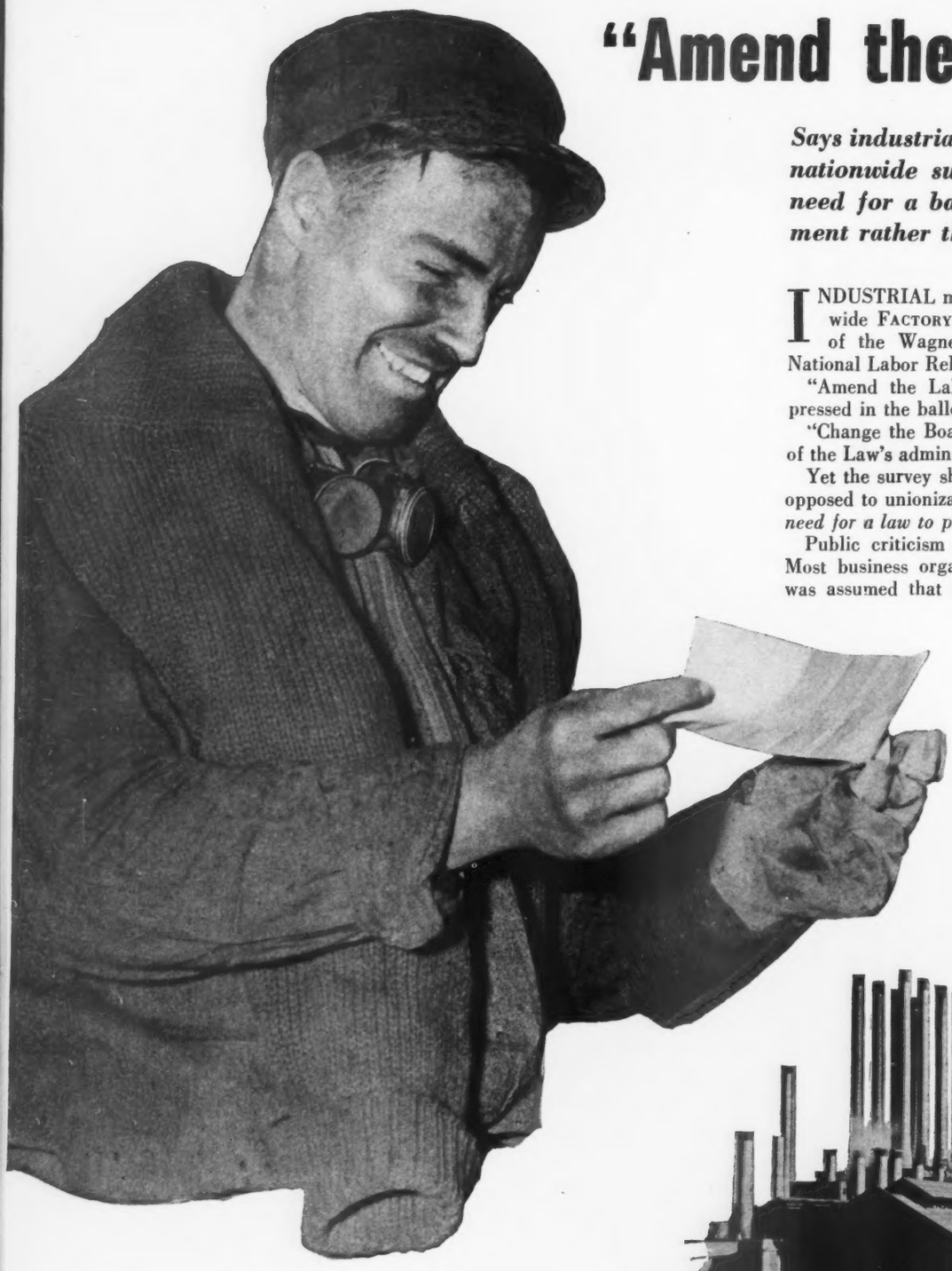
INDUSTRIAL management, voicing its opinion in a nationwide FACTORY poll, has voted a smashing condemnation of the Wagner Act, in its present form, and of the National Labor Relations Board, as at present constituted.

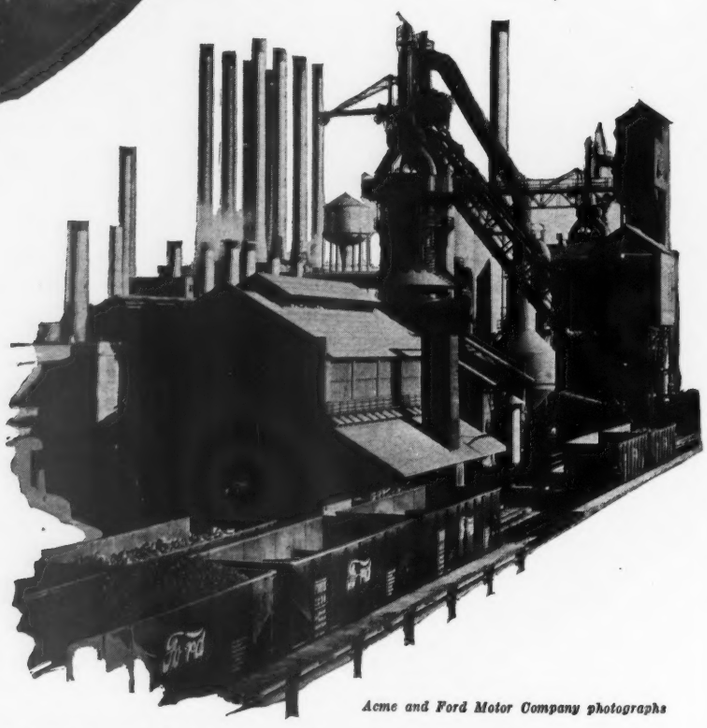
"Amend the Labor Law!" is management's demand, expressed in the balloting by a margin of 40 to 1.

"Change the Board!" is the verdict, 8 to 1, on the policies of the Law's administrators.

Yet the survey showed conclusively that management is not opposed to unionization and that *most management men see a need for a law to protect labor's organizing rights.*

Public criticism of Act and Board has been widespread. Most business organizations have sought reforms. Hence it was assumed that management men would favor some revi-





Acme and Ford Motor Company photographs

They called it "an act to promote equality of bargaining power between employers and employees, and to diminish the causes of labor disputes." Its sponsors predicted an era of industrial peace and prosperity

Change the Board"

sion. But far beyond all expectations was the actual extent of dissatisfaction that was revealed when the ballots were tabulated in *this first big test of industrial opinion.* For the current survey finds management even more rebellious and displeased than it showed itself to be in an earlier FACTORY poll, taken on a smaller scale, in August, 1937.

From plants large and small, in big cities and little towns, North, South, East, and West, came 1,500 ballots representing every sector of the manufacturing industries and every shade of managerial opinion. Tabulations showed that 1,448,661 persons are employed in the plants from which these ballots came.

All the usual management titles were represented in the returns—presidents, general managers, superintendents, production managers, personnel directors, plant engineers, master mechanics, maintenance engineers, and the rest.

One marked change in management's attitude is revealed in the results of the current survey. Today plant operating men are *thinking* the whole question of labor legislation *through* more thoroughly than ever before. Time has given perspective to their conclusions. Experience has given point to their

But industrial strife mounted steadily thereafter. In 1937 strikes hit new highs; 1,861,000 employees walked out. Industry lost 28,000,000 man-days of production. Wage earners lost 28,000,000 days' pay

****** *Factory* BALLOT ****** PLEASE CHECK YES OR NO ***********

	YES	NO
1. Do you think the Wagner Act has benefited:		
a. Industry?	107	1303✲
b. Labor?	563	865
c. The Public?	117	1279
2. Do you think there is a basic need for a law to safeguard the organizing rights of labor?	1024	413
3. Have you had occasion to deal with labor under the Act?	637	748
a. Were complaints filed against your firm with NLRB?	391	776
b. Were hearings held before the NLRB examiner?	226	819
c. Did you have a strike?	247	801
d. In any of the above cases, do you feel you were fairly treated by NLRB?	111	294
e. Do you think there would have been a labor dispute in your plant if there had been no Wagner Act?	64	776
4. (Answer ONE ONLY, please) Do you think the Act should be:		
a. Amended?	951	——
b. Repealed?	293	——
c. Unchanged?	13	——
5. Regardless of your answer to Question Four, do you favor the following proposed amendments to the Act —		
a. To prohibit unions from threatening or forcing men to join them?	1455	36
b. To allow employers to advise employees, by letter, in conversation, or in the press, against joining unions, providing no threats are used?	1206	255
c. To revise the Labor Board set-up with two distinct branches, one to prosecute cases and one to judge?	1262	131
d. To include on the Labor Board equal representation of labor, management, and the public?	1419	46
e. To allow employers, as well as unions, to request the Labor Board to hold plant elections?	1446	35
f. To require both employers and employees to sign contracts when an agreement is reached and to provide penalties for breach of such contracts?	1317	149
g. To prohibit the Labor Board from conciliating labor disputes?	926	437

✲ Results are based on a total of 1,500 ballots. That votes on a given question do not add up to 1,500 is explained by the fact that not everyone voted on every question.

Reproduction of FACTORY's ballot on the Wagner Act — with the overwhelming results filled in

***** TO REGISTER INDUSTRIAL OPINION **** *Factory* BALLOT ****

Question 5 (continued)	YES	NO
h. To permit strikes to be called only after a majority of all employees have voted by secret ballot to strike?	1378	82
i. To exempt an employer from the obligation to bargain, for a period of one year, with a labor organization if the employer can show before the Labor Board:		
1. That the real issue in the dispute is:		
a. The closed shop?	1193	191
b. The violation of an existing contract?	1093	214
2. That the organization is engaged in or has within one year been engaged in:		
a. A general strike?	982	306
b. A sit-down strike?	1176	143
c. Repeated or systematic acts of violence or destruction of property?	1216	105
6. Are you opposed on principle to the organization of employees by unions?	238	1229
7. Given your choice would you rather deal with the craft (AFL) or the industrial (CIO) type of union?	(AFL) 1022	(CIO) 202
8. If the appointive power were yours, would you continue the service on the Labor Board of—		
Chairman J. Warren Madden?	123	725
Edwin S. Smith?	76	750
Donald W. Smith?	78	753
Your regional director?	179	575

9. Have you any other amendments to suggest besides the ones mentioned above?

_____

_____

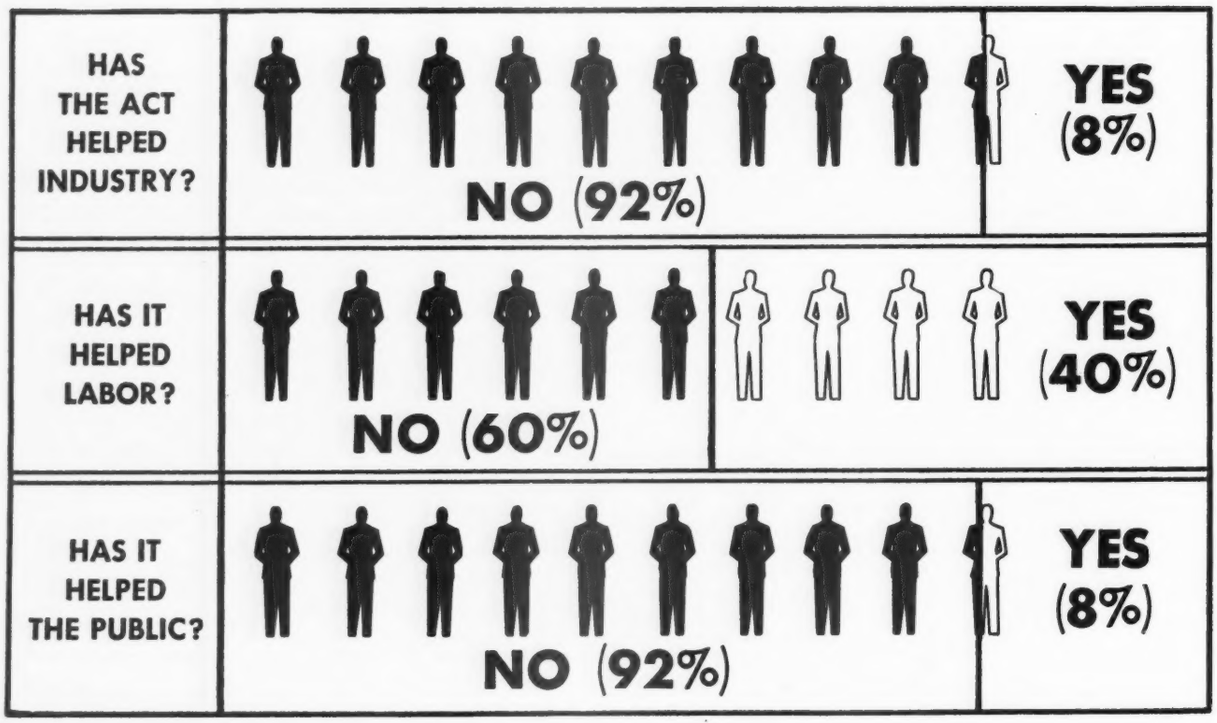
_____

10. In what industry are you engaged? _____

11. Your title? _____

12. Number of employees in your plant _____

Page 2 of the ballot. The sentiment of the men that are engaged in plant management is unmistakable.



protest. On many lesser points, differences of opinion were disclosed in the tabulations.* But on the need for fundamental change, agreement was literally almost unanimous. Reckoned from the answers to Question 4 ("Do you think the Act should be amended, repealed, or left unchanged?"), the demand for reform was overwhelming. Seventy-six per cent voted for amendment and 23% for repeal. A negligible number, only 1%, voted to leave the law unchanged.

The extent of the demand for drastic revision is measured more accurately, perhaps, by the response to Question 5a ("Do you favor an amendment to prohibit labor unions from threatening or forcing men to join them?"). Here the vote was "Yes" to the tune of 1455 to 36, with only 9 not voting.

This is a "key" amendment, an integral point in each of the reform programs proposed by the many business organizations now actively working for amendment of the Act. It has likewise been espoused by most of the political leaders pledged to fight for amendment at the new session of Congress soon to open. And it is particularly damned by those who have sworn to keep the Act intact.

On the general results of the Wagner Act's three-year history, management's judgment is also severe. To Question 1a (*"Do you think the Act has benefited industry?"*), 92% said "No." And 92% declared that the Act has been of no benefit to the public (Question 1c).

But opinion was more divided on the question of the law's benefit to labor (Question 1b).

Here 39% said "Yes."

Management's fundamental philosophy on the question of labor legislation is revealed most completely in the answers to Questions 2 and 6. Conclusions may prove surprising to readers outside industry.

1. *Management is not opposed on principle to the organization of employees by unions.* (Question 6: 84% *not* opposed.)

2. *Management believes there is a basic need for a law to safeguard labor's organizing rights.* (Question 2: 71% "Yes.")

* Results were tabulated for FACTORY by an outside agency. For facsimile of ballot and over-all tabulations, see pages 40 and 41.

Question 8, designed to reveal management's opinion of the individual members of the Labor Board, turned out to be a national *un*popularity contest. Many refrained from voting, over 40% in fact, but those that did held strong views.

"Send the whole bunch at Washington on a 99-year vacation to China," said one voter in an irate scrawl under "Suggestions." This was one of scores of such comments.

Of NLRB's triumvirate, Chairman J. Warren Madden came off slightly better in the voting than his colleagues, Edwin S. Smith and Donald Wakefield Smith. If there is any consolation to be gained from a difference in degree, Chairman Madden is entitled to rejoice in a moral triumph. For the vote against him was slightly less than 7 to 1, whereas the two Smiths went down under a crushing plurality of 10 to 1.

Closer to home for most voters was the last section of the question. Here they were asked to pass upon the performance of the Labor Board's regional directors. The vote on individual regional directors will be discussed separately. As a group, they fared much better than their Washington chiefs. But the vote against them was 4 to 1.

However, the widespread opposition to the Board appears to be founded in no small part on the way the Board is set up under the present Act. This fact is underlined by Questions 5c and 5d.

In the first (*"Do you favor an amendment to revise the Labor Board set-up with two distinct branches, one to prosecute and one to judge?"*), the answer was a resounding 91% "Yes." This, incidentally, is another "key" amendment—the only major point on which AFL seems at all likely to make common cause with the various business and industrial organizations working for amendment of the Act.

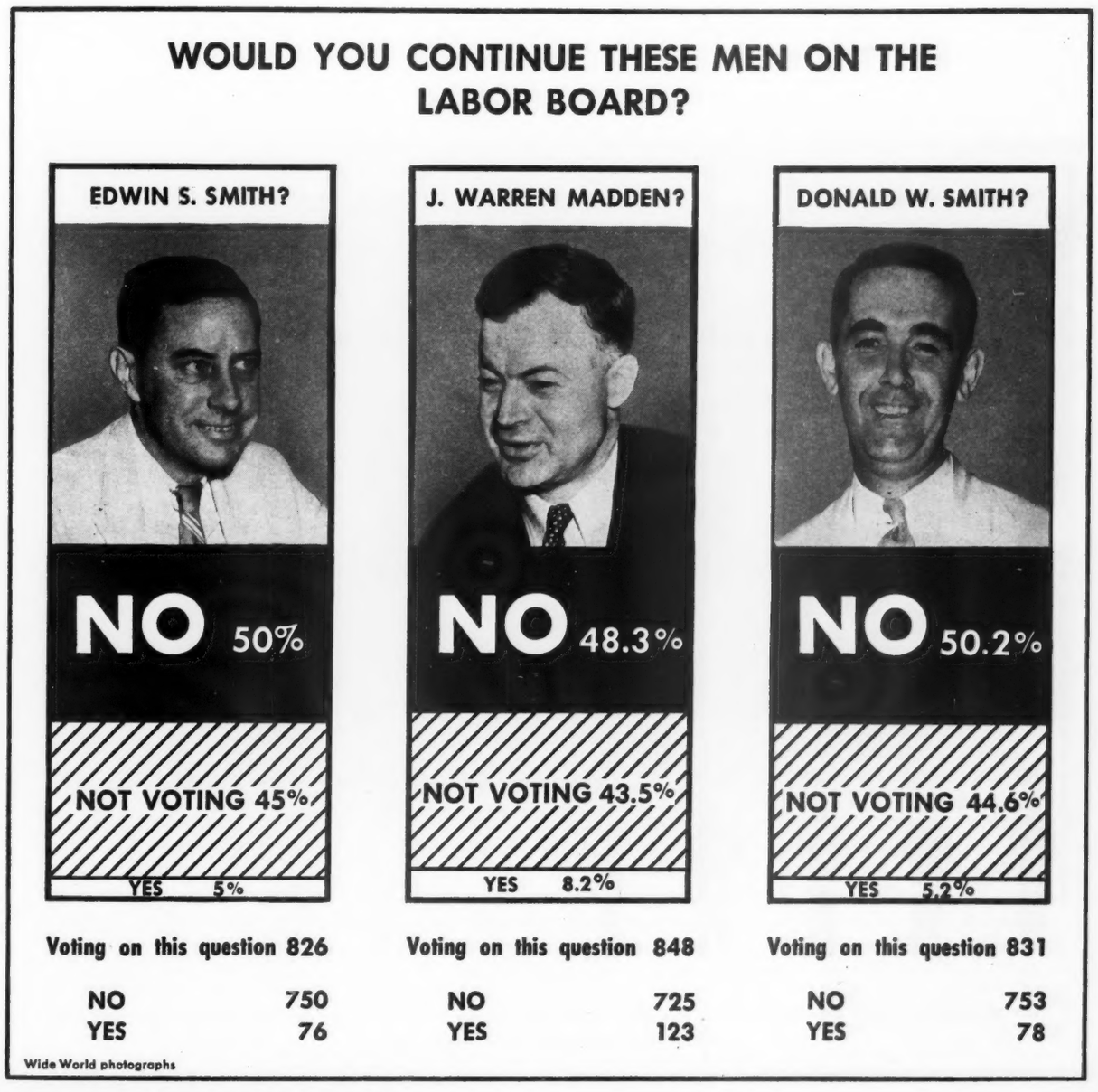
The demand for a change in the set-up is stressed even more strongly in Question 5d (*"Do you favor an amendment to include on the Labor Board equal representation of labor, management, and the public?"*).

"Yes," said 97%.

On another fundamental point agreement was just as complete. That was Question 5e (*"Do you favor an amendment to allow employers as well as unions to request the Labor Board to hold plant elections?"*).

Here 98% voted "Yes."

Surprisingly strong was manage-



ment's opinion that both employers and employees should be required to sign contracts when they reach an agreement, and that penalties should be provided for breach of such contracts (Question 5f). Ninety-one per cent voted "Yes," although many voters added that employers should be expected to sign contracts only with responsible unions.

Not nearly so positive was the support given an amendment *"to prohibit the Labor Board from conciliating labor disputes"* (Question 5g). To this, 68% said "Yes." In theory, the Labor Board has no conciliation function. But in practice it has settled disputes again and again through its regional directors. The question was included because many employers have complained that the Labor Board is prone to perform "shotgun weddings" by promising to pigeonhole Wagner Act charges against employers in return for concessions to labor.

A proposal that might be expected materially to reduce the number of strikes was set forth in Question 5h (*"Do you favor an amendment to permit strikes to be called only after a majority of all employees have voted to strike?"*).

Ninety-four per cent of the voters said "Yes."

Certain "unfair practices of labor" are defined in Question 5i. Chief of these are the sitdown strike, the general strike, the violation of existing contracts, and acts of violence and destruction of property. All these were advanced in the proposed amendment as grounds for exempting an employer, for a period of one year, from the obligation to bargain with labor unions engaging in such practices.

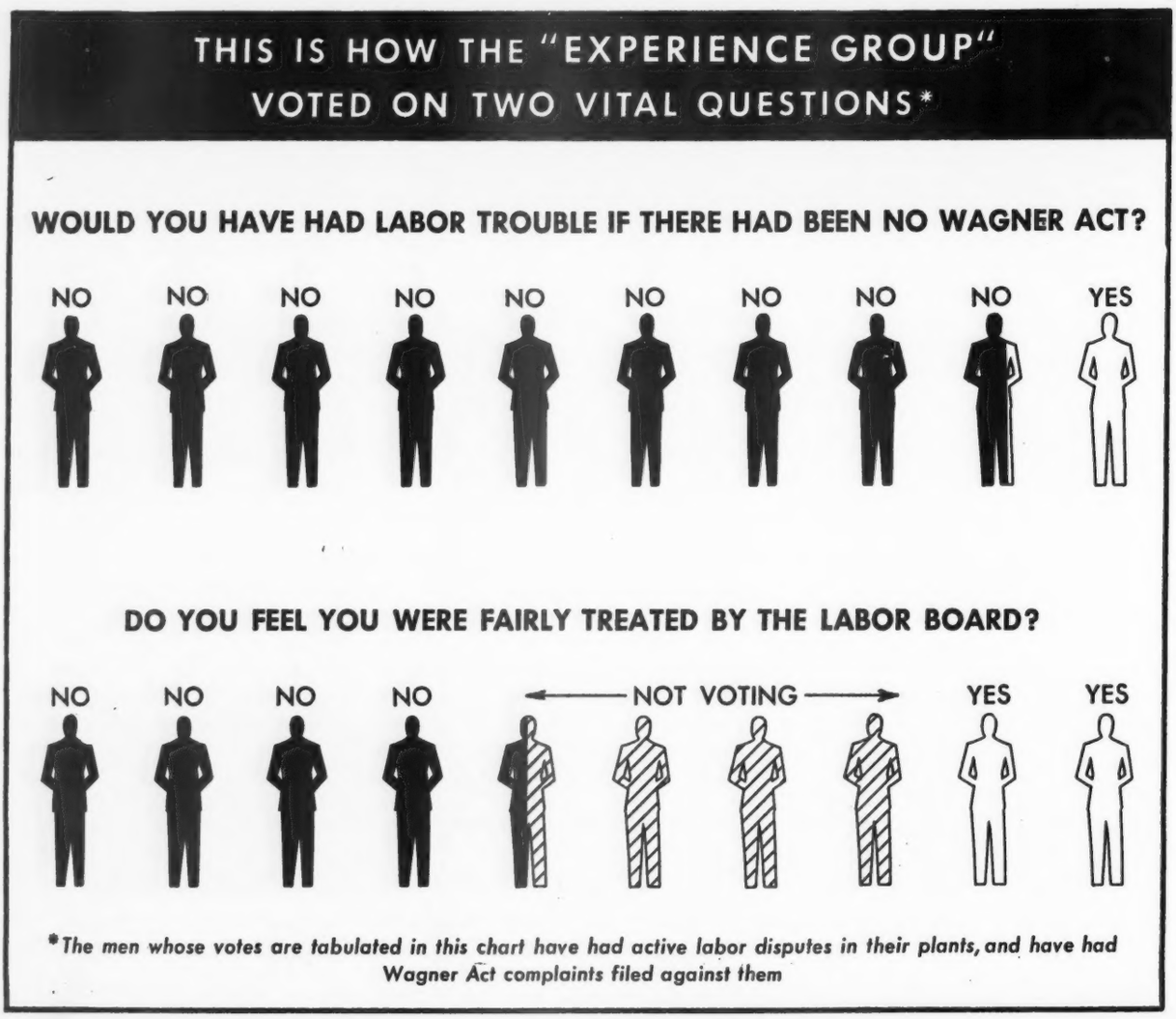
89% for Exemption

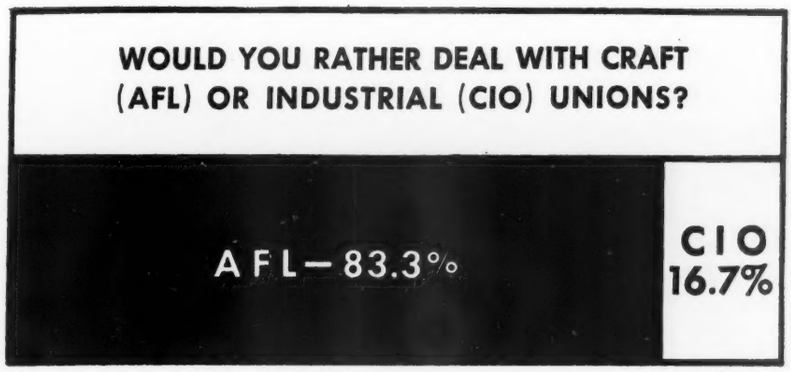
"Exempt the employer by all means," said management, "if it can be shown that the union has, within the previous year, conducted a sitdown strike (89%) or been responsible for repeated or systematic acts of violence and destruction of property (92%), or if it can be shown that the *real issue* in a dispute is the violation of an existing contract (84%) or the prosecution of a general strike (76%)." And 86% voted that an employer should not be compelled to bargain with a union if he can show that the real issue is an attempt to gain a closed shop contract.

By 4 to 1 or better, management thus condemns labor union actions that the Labor Board, in many of its rulings, has upheld.

Management is somewhat more tolerant of the general strike than of the sitdown strike, and it is slightly more patient with labor's attempts to upset existing contracts than with efforts to obtain the closed shop.

Over 400 voters filled in Question 9, the space reserved for additional suggestions. More than 50% urged government regulation of labor unions, compulsory incorporation, and strict public accounting of dues. Most of these recommended that unions be made financially responsible for damages suffered by employers through strike violence.


THIS IS HOW THE "EXPERIENCE GROUP" VOTED ON TWO VITAL QUESTIONS*
WOULD YOU HAVE HAD LABOR TROUBLE IF THERE HAD BEEN NO WAGNER ACT?
NO NO NO NO NO NO NO NO NO YES
DO YOU FEEL YOU WERE FAIRLY TREATED BY THE LABOR BOARD?
NO NO NO NO ← NOT VOTING → YES YES
*The men whose votes are tabulated in this chart have had active labor disputes in their plants, and have had Wagner Act complaints filed against them



Scattered votes were recorded for amendments to establish the validity of company unions, to outlaw sitdown strikes, to outlaw the closed shop and check-off, to bar aliens from union membership, to restrict picketing to employees of the plants involved, to establish compulsory arbitration with a ban on strikes and lock-outs.

Comments Were Caustic

"Take labor relations out of politics," said a Rhode Island production manager, and other voters echoed his words.

"The Wagner Act should be junked and a new Act set up along English or Swedish lines," said the general superintendent of a Pennsylvania mill. "The closed shop and check-off should be barred."

A number of other voters also advocated the voluntary arbitration plans of England and Sweden as described by Edward J. Mehren in recent issues of FACTORY.

Most interesting of the suggestions came from the general manager of a Brooklyn plant. He said:

"Appoint to NLRB an accountant to examine the books of any company that feels a union is asking an exhorbitant raise."

This man said he had had hearings and decision on a Wagner Act complaint against his firm, and felt the Board had treated him fairly.

By a ratio of 6 to 1, management expressed preference for the craft (AFL) type of union to the industrial (CIO) type as a bargaining unit. Personal views were apparent in some replies. Many penciled comments, unfavorable to CIO leadership, appeared in the margins.

And one stout foe of all unionism refused flatly to consider any such alternative.

"Neither," said he. (But he spoke for a minority that amounted, nationally, to less than one in seven of all the voters.)

"Some interesting geographical differences were revealed by Question 6 (*"Are you opposed on principle to the organization of employees by unions?"*). Opposition to unionism proved to be strongest in the South, where unionism is weakest, and weakest on the West Coast, where unionism is perhaps strongest.

FOUR OUT OF FIVE MEN ENGAGED IN INDUSTRIAL PLANT MANAGEMENT FAVOR—
AN AMENDMENT TO PERMIT EMPLOYERS TO ADVISE EMPLOYEES AGAINST JOINING UNIONS

Such opposition was expressed by 25% of the voters in the South Atlantic states; 24% in the West South Central states; 21% in the East South Central group; 16% in the New England, East North Central, and West North Central states; 14% in the Middle Atlantic group; and less than 11% in the Pacific Coast and Mountain states.

Opposition in the South

Correspondingly, a higher percentage in the Southern states, particularly in the South Atlantic region, declared they could see *no* basic need for a law to safeguard labor's organizing rights. Forty-four per cent of voters in the South Atlantic states took this view in contrast to the national average of 29%.

In all industries, the essential outlook of management men appears to be about the same. But, in very large plants and very large cities, the attitude towards unionism and labor regulation by law is somewhat more liberal. For example, 29% of the voters from plants having less than 1,000 employees can see no need for a labor law. In plants of 2,000 employees or more, only 23% took this view. Similarly, 19% of the voters in towns of less than 2,500 population expressed open opposition to union organization. In cities above 500,000, only 11% are so oposed. If there is any difference here, "Little Business" appears to be even more conservative than "Big Business."

Tabulated separately were the votes of those whose replies showed they had had actual contact with the Labor Board. Only those that had had Wagner Act complaints filed against their firms were included in this listing. These men were placed under the heading of "The Experience Group," and their replies on certain questions were analyzed alone.

This is what they think:

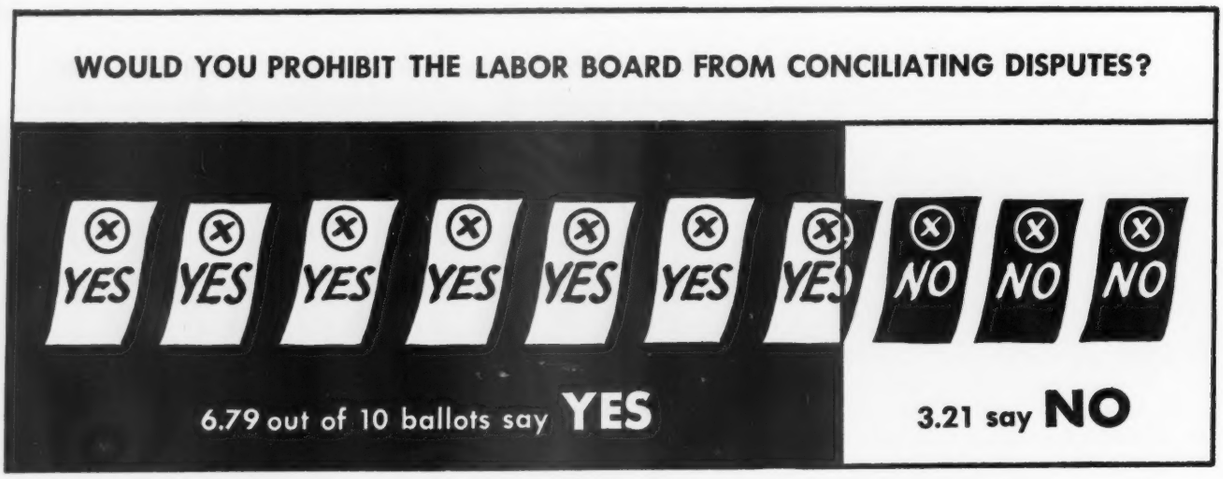
1. They are still firmly convinced that there is a basic need for a labor law. (In fact 75% of them, slightly more than the average, so voted.)

2. They are still *not* opposed on principle to unionization. (In fact 85% of them are not so opposed, and this again is slightly better than the general average.)

3. They are even more certain that *no labor disputes would have occurred in their plants if there had been no Wagner Act.* (Eighty-seven per cent expressed this view.)

4. They are convinced, 3 to 1, that they were *not* fairly treated by the Labor Board and its agents. (Question: *"Do you feel you were fairly treated by NLRB?"* Answer: "No" (68%), "Yes" (32%).

These conclusions are qualified by the fact that they represent only the opinions of those who actually voted on the issues. For example, 34% did not state whether they felt they had been fairly treated by the Labor



Board. Doubtless many of these were still awaiting NLRB decisions. For the same reason, probably, 36% of the "Experience Group" failed to record their vote on reappointment of regional directors.

Following is a comparison of the "Experience Group's" vote on the reappointment question compared with the general average:

Experience Group		*Average*
A. Chairman J. Warren Madden		
8.6%	Yes	8.2%
35.0	Not Voting	43.5
56.4	No	48.3
B. Edwin S. Smith		
4.8%	Yes	5.0%
37.4	Not Voting	45.0
57.8	No	50.0
C. Donald W. Smith		
4.6%	Yes	5.2%
36.4	Not Voting	44.6
59.0	No	50.2
D. Your regional director		
16.8%	Yes	12.0%
36.2	Not Voting	49.7
47.0	No	38.3

In every instance, the "Experience Group" voted "No" by a higher percentage, but they gave a better rating to regional directors, and more of them voted on this question. This may indicate that the regional directors have succeeded in making a few friends through direct contact with management. Certainly it shows that management men who have had such contact are considerably more positive in their opinions.

"Right and Left Wings"

Two other special groups merit separate analysis. They will be described as "The Right Wing" (those that do *not* believe there is a basic need for a labor law) and "The Left Wing" (which includes those that believe the law should be left unchanged and those that believe the law has benefited not only labor but industry and the public as well).

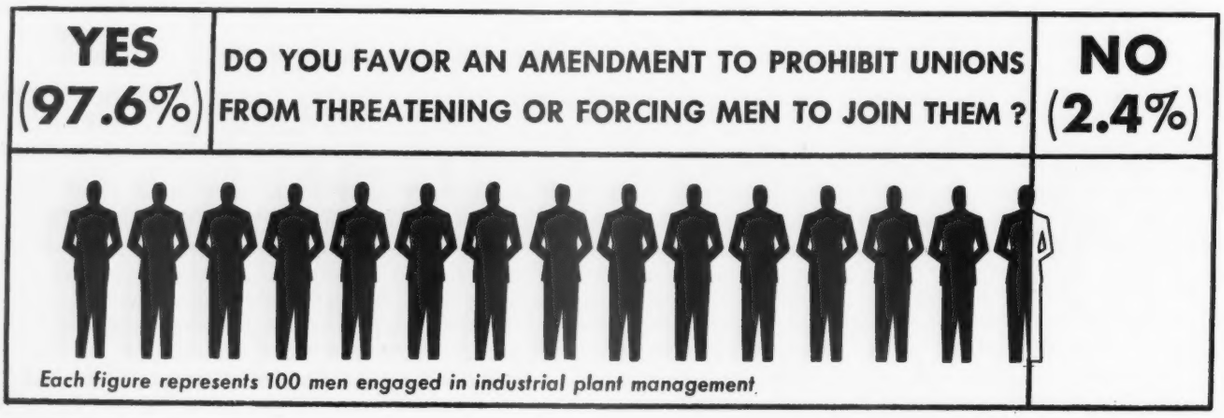
Three times as many in the "Right Wing" group are opposed on principle to unionism. But 84% of those in the "Left Wing" endorsed the amendment to prohibit unions from the use of threats and violence. While this was well below the general average, it is still an indication of agreement on a fundamental point. In short, those who are basically opposed to *all* labor laws, and those who *especially favor such laws*, are generally agreed that *this* law needs a drastic change.

On the question of reappointment, the "Right Wing" says "No" right down the line—Madden 92%, E. S. Smith 92%, D. W. Smith 95%, and regional directors 84%. The "Left Wing" says "Yes" to all of them—Madden 58%, E. S. Smith 54%, D. W. Smith 51%, and regional directors 62%.

The smallest vote from both sides goes to D. W. Smith, whose reappointment comes up for confirmation in the Senate soon. A lively fight is due to develop on this point, the curtain-raiser to a larger struggle over amendment of the Act. All the influence of AFL and the employer groups will be thrown together against Smith. Not long ago, Sen. H. Styles Bridges of New Hampshire announced that he had conferred with his colleagues of both parties during the recess and that he saw a "real possibility" of blocking Smith's confirmation.

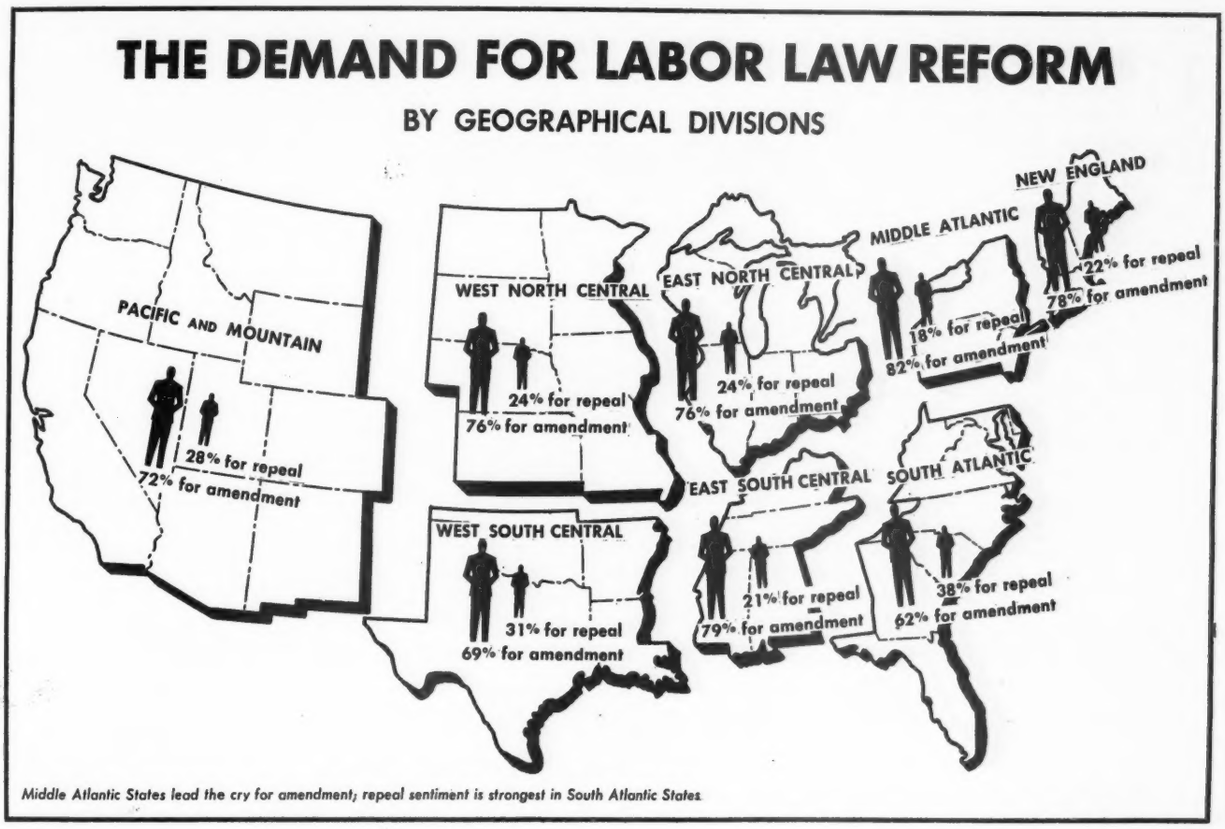
Either way, this scrap will strongly influence the amendment battle. Three months ago there seemed not the remotest chance that the amendment question would get to a vote. But the November elections and other events since then seem symptomatic of a change in the public mind and, as always follows, the political mind.

Institute of Public Opinion polls


YES
(97.6%)
DO YOU FAVOR AN AMENDMENT TO PROHIBIT UNIONS FROM THREATENING OR FORCING MEN TO JOIN THEM ?
NO
(2.4%)
Each figure represents 100 men engaged in industrial plant management

show a shift in sentiment for amendment between last May and November. (Dr. George Gallup's November report: For amendment 52%, for repeal 18%, for no change 30%.) Meanwhile a United Press poll of the incoming Congress revealed strong support for changes in the Act.

All these are new trends, likely to there is not even one. AFL, at its Houston convention in October, endorsed nine proposed amendments—all technical, and none calculated to limit the privileges under the Act of anybody but CIO. However, the convention *did* denounce D. W. Smith. And the resolutions committee *did* recommend an amendment to split the party lines with the spotlight on the stalwarts of former struggles—Vandenberg of Michigan leading the Republicans, Burke of Nebraska the conservative Democrats, and Wagner of New York, author of the Act, the "liberals" of all shades. New faces will appear in both camps, more among the pro-amendment groups.



Middle Atlantic States lead the cry for amendment; repeal sentiment is strongest in South Atlantic States.

gain. Granting this, it seems likely the Act will be amended.

But in what way will it be amended? Will Congress merely tinker with it, adopt a few minor changes? Or will there be a basic change—what the lawyers call a "substantive" amendment?

Any one of the amendments set forth in FACTORY'S ballot may be considered substantive. They are a virtual digest of the various proposals advanced by the U. S. Chamber of Commerce, the National Small Business Men's Association (an extremely active force), and, in the past, by the National Association of Manufacturers.

Most Likely Amendment

If the employer groups could find common ground for collaboration with AFL on some one substantive amendment, that amendment would have the best chance of passage. But Judicial and administrative functions of the Labor Board (5c). The convention passed it up, but the AFL high command may press for it unofficially.

Even the Labor Board

Second most likely amendment is the one that would give employers the right to petition for NLRB elections. Even the Labor Board has talked of changing its regulations on this point. Some observers have conjectured that President Roosevelt may have had this one in mind when he was indirectly quoted as favoring amendment of some sort. But just what he thinks is still a mystery, and on that mystery hinges the outcome. For he still marshals majorities in Congress on most measures. And he can still wield his veto powers against any amendment he doesn't approve.

Chances are the battle will form on Rumors that Burke will play a minor role this year are ill-founded.

CIO pressure on behalf of the Act will not be so potent. Voting will bring out some of the same alignments witnessed in the defeat of the court and reorganization bills. Almost any substantive change faces a sure veto. Two-thirds majorities to offset this seem doubtful.

If Management—

This much is certain, however. If America's men in industrial management were to occupy the seats of the mighty in Congress and the White House for as much as a single day, the Wagner Act would be speedily and drastically amended, and the entire personnel of the Labor Board would be changed in the twinkling of an eye.

(*Although Chairman Madden might be given a chance to stop for his hat on the way out.*)

THEY BURIED THE AX

Six unions smoke a perpetual peace pipe with management at Consolidated Film. Voluntary arbitration works here even as it works in Britain. Strikes are barred. Wages up, costs down

CHARLES B. COATES
Assistant Editor

PUBLIC RELATIONS
Industry's Biggest Job

UNION AND MANAGEMENT never cease negotiating in the three diversified plants of Consolidated Film Industries, Inc. These negotiations never result in blanket, long-term wage increases or contracts. Yet wages—and efficiency—are increasing steadily. And labor costs have actually gone down.

Consolidated does business on a closed-shop basis with six different unions, both AFL and CIO, representing 2,500 skilled and unskilled employees. Practically the only contracts in effect are the "perpetual" contracts which give *legal status* to a Relations Committee in each plant. These committees settle all questions on a month-to-month basis. Arbitration is automatic. Strikes are barred.

The frequency of committee meetings permits an individualized attention to labor problems that would be impossible if the company as a whole were to attempt to deal with the unions as a whole once each year. It also precludes the annual "crisis" of contract negotiations and prevents the accumulation of small problems.

In each plant the Relations Committee deals with wage and hour questions solely in the light of their effect on general efficiency and morale. Occasionally it acts on demands affecting an entire department. More often it raises the hourly wage of Adam K. Jones, pressman, by 5 or 10 cents. The unionist who recommends the raise must be prepared to prove that Jones is doing good work and deserves a reward.

All the unions in each plant are

Relations committee on the job at the Consolidated Film plant, Fort Lee, N. J. It includes representatives of management and employees, and business agents of local unions. Second from right, production manager Joe W. Coffman, presiding

represented on the committee. Thus the leaders of one union pass upon the demands of another. Since each is looking to his own laurels, all of them are surprisingly hard-headed and critical. They realize that the company must be kept in a financial position to meet their demands.

And how is this working out? Well, the idea is young yet, but here are the immediate results:

1. The men are getting what they want—higher wages, better conditions.

2. The unions are getting what they want—full recognition and the closed shop.

3. The company is getting what it wants — cooperation of the men through the union and lower costs per unit of production.

This sounds all-fired impossible. To believe it, you have to talk personally to the union leaders, the men in the plant, and the executives. What you find is an industrial relations setup that seems to combine the advantages of craft, company, and industrial unionism, and puts a full share of the responsibility for its success squarely on the shoulders of the union heads and the employees themselves.

Under such circumstances one might look for industrial idealists on the executive side of the fence. But Consolidated's president, H. J. Yates, Sr., is a hard-hitting, practical motion-picture man who has led Consolidated from the status of a minor "film laundry" to a dominant position in its field, and who has made his name a byword for efficiency in an industry frequently criticized for inefficiency. Solely on grounds of efficiency, Mr. Yates has approved the Relations Committee plan as originated and developed by Consolidated's production manager, Joe W. Coffman.

Born of strikes, the plan has stopped strikes. Conceived in recognition of the Wagner Act, it has absolutely obviated government intervention. Not one case has gone to the Labor Board from Consolidated since the plan went into effect.

Relations Committees have been functioning for nearly two years at Consolidated's Scranton, Pa., subsidiary, Consolidated Molded Products Corporation; for one year at its main, Fort Lee, N. J., plant; and for nearly a year at its Bridgeport, Conn., subsidiary, American Record Corporation.

Scranton and Fort Lee were the scenes of bitter strikes before the committees were instituted. Since then there hasn't been the smell of a strike. Two of the most militant former strikers are now ardent committeemen.

Why This Plan Works

1. MANAGEMENT CONCEDES FULL UNION RECOGNITION
2. THE UNIONS PROMISE NOT TO STRIKE
3. BOTH PARK THEIR SHOOTING IRONS OUTSIDE THE CONFERENCE ROOM

It's Cash in the Bank

From the company's viewpoint, the results are like cash in the bank. No starry-eyed visionary is Production Manager Coffman but a level-headed realist who dislikes costly stoppages and slowdowns. Consolidated's remarkably detailed cost accounts show that although wages have risen since inception of the plan, labor costs have declined thanks to increased machine output and decreased waste.

At each committee meeting a secretary keeps scrupulously exact minutes. Every agreement reached and recorded in the minutes becomes *legal and binding* by reason of the contract on which the committee's existence is based.

The committee contract is thus a sort of constitution, and the minutes of the meetings form a continuing series of amendments. The committee is actually a labor legislature.

"Grievances" are mentioned neither in the contract nor in the minutes of the meetings. The word is consciously avoided. An individual complaint, unburdened by the dread formality—and rancor—of a "grievance" can stand or fall on its own merits before the committee.

For the same reason there is never any talk of "arbitration," although the machinery is all set up and ready to start whirring at any time that the Relations Committee hits dead center. But the arbitration group is called a "Negotiation Committee." Here is the arbitration clause in the Relations Committee contract:

> In case of failure to reach an agreement, between the parties through their representatives on the Relations Committee, each party shall designate one negotiator. The two negotiators shall then make an effort to arrive at an agreement, and such an agreement, if and when arrived at, shall have the same force and effect as a decision of the Relations Committee.
>
> In case of failure of the two negotiators to reach an agreement, they shall agree upon a third impartial negotiator, and the decision of this negotiation committee of three shall be made by majority vote and shall have the same force and effect as a decision of the Relations Committee and shall be final and binding upon both parties. It is mutually agreed that all arbitration expense shall be equally divided between the two parties.

All of which is stated with a terseness that causes one to wonder whether anything so simple can be legal. But your investigator has shown it to several lawyers who agree that it is probably quite airtight.

In another clause, the union pledges itself and its members to:

> abide by all regulations established by the company reserving the right of appeal to the Relations Committee, and shall discipline any members who shall conduct themselves in such a manner as to bring reproach to the union. . . . It further agrees to advance the interests of the company in every honorable and practical manner.

Last, the contract says:

> Inasmuch as Section Six provides for the establishment of mechanism for the adjustment of all matters of mutual interest which may arise, it is agreed that under no circumstances shall there be a stoppage of work or employment due to strikes or lockouts.

Now how does this work out in actual practice? Let's attend a meeting of the Relations Committee at Consolidated's brisk and modern Fort Lee plant. Here the company prints about one-third of the nation's motion picture film, manufactures motion picture equipment, and produces movie "stills" and lobby display cards. It

The display posters you see at the movies are only one of many products made in Consolidated Film's compact plant at Fort Lee, N. J. It turns out "still" photographs by the millions. It prints one-third of the nation's motion picture film. Unexposed film is fed into its printing machines, printed with picture and sound tracks, developed, rinsed, fixed, inspected, and packed ready to ship—all in 40 minutes

also operates a job printing plant. In its own machine shop it designs and builds the high-speed machines used in its other operations.

Five different AFL unions are represented at Fort Lee. The number of unionists on the committee there will not be fixed at a definite limit until all the unions sign the committee contract. One, Local 702 of the International Alliance of Theatrical Stage Employees and Motion Picture Operators of the United States and Canada, is "sitting in" under an informal agreement. For the present the average number of unionists on the Fort Lee Committee is eight. No matter what the number, a majority of the unionists must agree with a majority of the company representatives.

Present at today's meeting are nine unionists and four managers, Mr. Coffman presiding. Everyone is in shirt sleeves, yet the tenor of the meeting is somewhat formal. While the negotiators are cordial, they are not on any "Jack-and-Bill" basis of false heartiness. On the other hand, no one shouts or pounds the table.

Order of business opens with a discussion of "Union Membership." Left over from the last meeting is an item concerning four delinquent duespayers. The union organizers now report that the lost lambs have returned to the fold. Item is stricken from the agenda.

About the Restaurant

The talk now turns to the Committee for Athletic and Social Activities known as CASA. This group, composed both of unionists and managers, functions parallel but is subordinate to the major committee. The committee discusses the plant restaurant, run by CASA. The restaurant, operating at a small deficit which the company pays, is in a transitional state between paternalism and collectivism. Because the men participate in its operation, there is no longer any suspicion that "the company is making money on us." On the other hand, if the restaurant does make money, the profits will go into CASA's coffers to finance dances, baseball, badminton, croquet, ping-pong.

Next subject is "Union Cooperation." Company's previous requests for union's help in enforcing company regulations, among them the very important (in a film plant) "No Smoking" rule, have apparently met with response. Brief discussion ends with statement, inserted in minutes: "The company representatives report that the company is receiving effective cooperation from all of the unions represented on the committee."

Next item is "Requests for Wage Increases." These are few, the number having dwindled notably since the recession. Here are two sample excerpts from the minutes of previous meetings:

The union requested that John F————, pressman, be rated as a second

(Continued on page 118)

MOTION STUDY RESEARCH

1. How Bevel Affects Pin-Positioning Time

RALPH M. BARNES
Professor of Industrial Engineering
University of Iowa

OBJECT of this investigation was to determine the effect on positioning time of changing the amount of bevel surrounding a hole in a steel bushing into which a pin was to be inserted: *A*, when there was only a small clearance (0.002 inch) between pin and hole (this situation is analogous to a "go" gage for gaging small pins, shafts, and similar parts); and *B*, when there was a considerable clearance (0.010 inch) between pin and hole (this situation is analogous to the assembly of pins, bolts, screws, etc., in holes).

Parts Used—Pins were made of cold rolled brass rod polished to 0.248 (+0.0015 or —0.0005) inch in diameter, 1.25 inches long, with 3/32 in. bevel at each end.

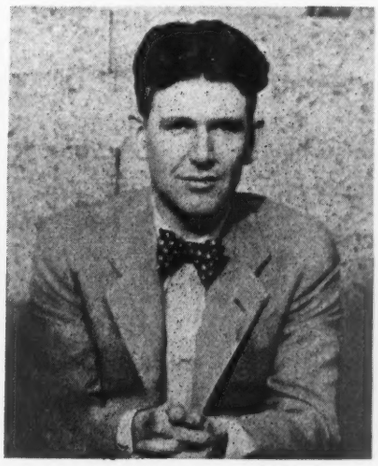
Five steel bushings were made of cold rolled stock turned to the dimensions shown in Figure 1. The bevel was carefully polished; the holes were drilled, reamed, and polished to a diameter of 0.250 (+0.001 or —0.000) inch for part *A* of the study, which gave a clearance of 0.002 inch between pin and hole.

An identical set of bushings were used for part *B* with the exception that holes were 0.258 (+0.001 or —0.000) inch in diameter which gave a clearance of 0.010 inch.

Equipment Used—To simulate operating conditions in the factory, the interruption of a beam of light falling on a photoelectric cell was used to determine the end of the *transport loaded* and the beginning of the *position* motions, since this device did not interfere in any way with the smooth and natural performance of the operator.

The workplace was arranged as shown in Figure 2.

Apparatus consisted of a magazine, *A*, containing 50 brass pins. The sides of the lower end of the magazine were cut away so that the bottom pin could easily be grasped by the thumb and index finger of the right hand. A light metal bar, *B*, called a thumb-trip, was mounted on the magazine and extended in front of the bottom pin, so that the operator, without interrupting his movement, pushed the trip back with his thumb as he grasped the bottom pin.



Ralph Barnes got his early industrial training with an optical company, a machine tool concern, and a manufacturer of cameras and photographic equipment—all in Rochester. Taught at University of Illinois. Switched to Iowa. In charge of work in industrial engineering; heads a program of research in motion study; is also Director of Personnel for the College of Engineering. Is the author of "Motion and Time Study," and a frequent contributor to FACTORY.

As the trip was pushed back it moved a mercury switch, which in turn was connected to a solenoid-operated pencil on a kymograph.* The kymograph contained a strip of paper moving at uniform velocity. A movement of the pencil point made a jog on the moving strip of paper (see Figure 3), and since the paper moved at exactly 31.9 inches per second, distance between jogs indicated the time between the various motions or therbligs in a cycle. Readings were made in thousandths of a second.

Line *A* (Figure 3) was made by the solenoid-operated pencil connected to the thumb-tripped switch. Since the operator pushed this trip back when beginning to grasp the pin, the time that this circuit was closed was the *grasp* time. Although this included the first quarter-inch of the *transport loaded*, this additional time was but a minor part of the total time and was practically uniform for all cycles. Thus T_G on line *A* was a measure of the *time to grasp*.

The operator then carried the pin in his right hand toward the edge of the table and inserted it in the hole, *E*, of the steel bushing, *D*. As he withdrew the pin from the magazine it was in a horizontal position. As the pin was carried, he positioned it so that it was vertical when it reached the edge of the bushing.

Photoelectric Accuracy

A beam of light, *C*, passed across the edge of the bushing and fell on a photoelectric cell mounted rigidly in a position directly to the right of the bushing. The light source was positioned so that the beam passed across the top of the bushing. A vertical slot 1/8 inch wide and 1/2 inch long was made in a black paper cap which covered the photocell. This slot was so positioned that as the brass pin was carried from the magazine it interrupted the beam of light when the pin was one-half inch from the center of the hole.

This was kept constant for all five bushings. As the beam of light was cut off by the pin, the pencil made a jog in line *B*. The solenoid was operated through two relays connected to the photocell. The beginning of the job was regarded as the beginning of the *positioning* and the end of the *transport loaded*, which began when the *grasp* ended. Thus T_{TL} on line *B* was a measure of the *transport loaded* time.

It is possible that there was a slight lag through the relays which would have caused the *positioning* time to have appeared shorter than it really was, but this effect would

* A recording mechanism of the type found, to cite a common example, in graphic meters—ED.

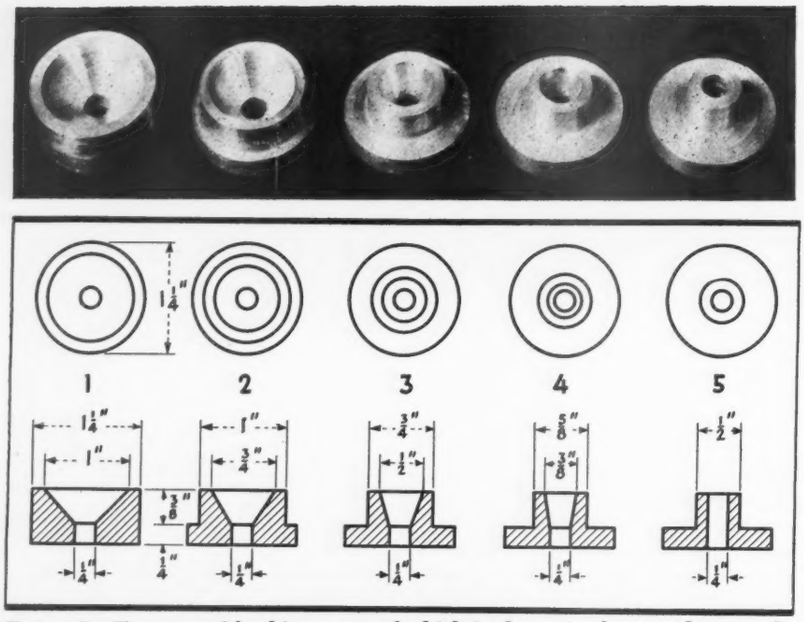


Figure 1. Two sets of bushings, one of which is shown in the top photograph, were used. For part *A* the diameter of the hole was 0.250 inch, which gave a clearance of 0.002 inch between pin and hole. For part *B* the diameter of the hole was 0.258 inch, which gave a clearance of 0.010 inch

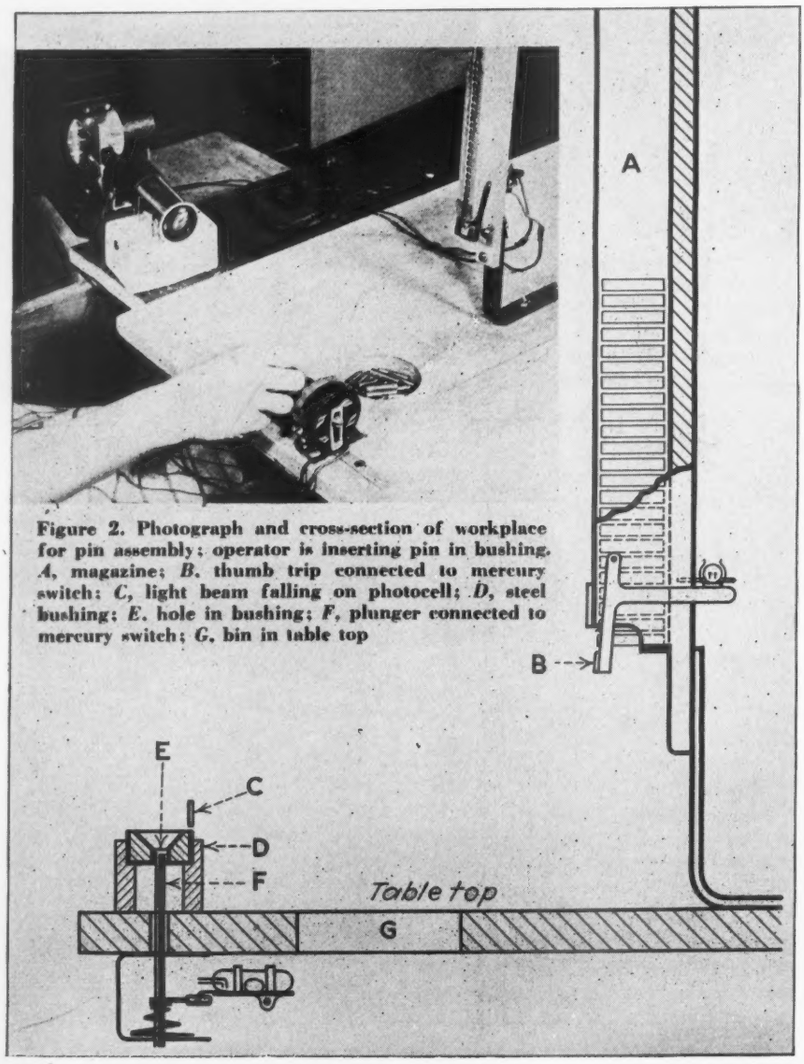


Figure 2. Photograph and cross-section of workplace for pin assembly; operator is inserting pin in bushing. *A*, magazine; *B*, thumb trip connected to mercury switch; *C*, light beam falling on photocell; *D*, steel bushing; *E*, hole in bushing; *F*, plunger connected to mercury switch; *G*, bin in table top

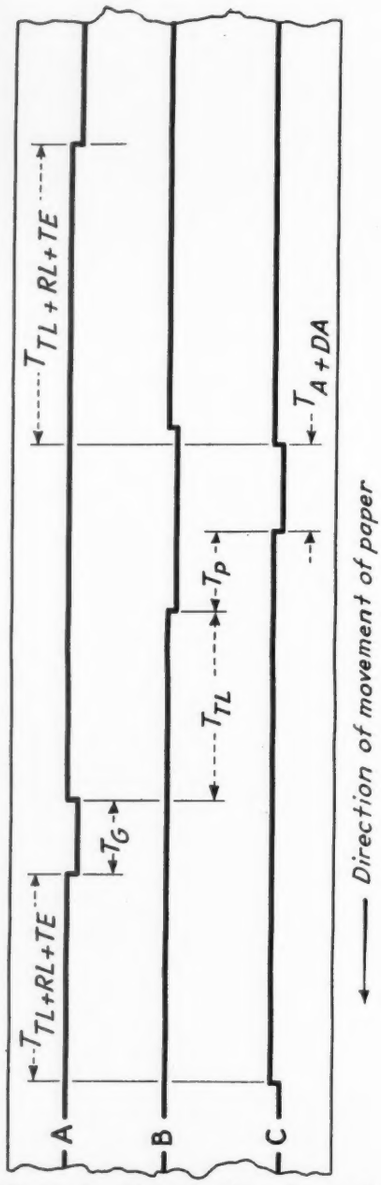


Figure 3. Reproduction of record made by solenoid-operated pencil on kymograph. Since the paper moved at exactly 31.9 inches per second, distances between jogs represent times for the motions in a cycle. Readings were made in thousandths of a second

be the same for all bushings and consequently would not affect the difference in *positioning* between bushings.

In order to measure the *time to position* the pin in the hole, a plunger, directly connected to a mercury switch, was placed in the hole. The top of this plunger projected to within ⅛ inch of the lower edge of the beveled part of the bushing, and the plunger could be depressed ⅜ inch by inserting the brass pin in the hole and pushing it down as far as it would go. The switch connected to

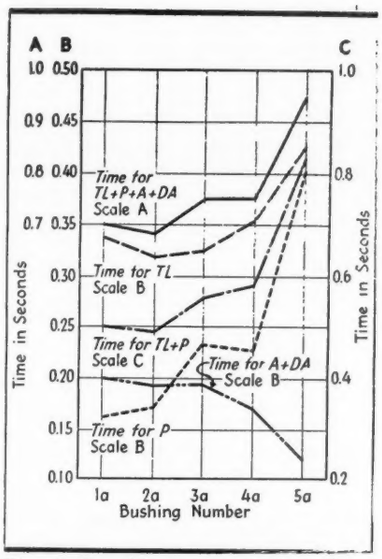


Fig. 4. Graphic representation of results. Curves show average of median values (selected by total time for *transport loaded, position, assemble,* and *disassemble)* of seven operators. Clearance between pin and hole was 0.002 inch

the plunger actuated a solenoid-operated pencil which drew line *C* on the moving strip of paper.

The plunger switch closed the circuit when the pin was $\frac{3}{16}$ inch down in the hole and did not open the circuit until the pin had gone down another eighth of an inch and returned to within $\frac{3}{16}$ inch of the top of the hole.

On bushing No. 5 there was no bevel, and the vertical distance corresponding to the bevel on the other bushings was ¼ inch in diameter, the same diameter as the hole. The plunger occupied the same position when used with bushing No. 5 as with the other bushings, hence this extra quarter-inch of travel through the upper portion of the bore was recorded as part of the *positioning* time as was the travel through the beveled sections of the other four bushings.

Time to Position

The beginning of the jog in line *C*, made by a solenoid-operated pencil connected to the plunger circuit, was regarded as the end of the *positioning* time. Thus T_P on line *B* was a measure of the *time to position* the pin in the hole.

Since the movement of the pin downward into the hole was considered as an *assemble* therblig and the withdrawal of the pin from the hole a *disassemble* therblig, T_{A+DA} on line *C* was a measure of the two.

TABLE I — RESULT SHEET

Medians selected by total of time for transport loaded, position, assemble, and disassemble for seven operators. The averages of the medians are also shown. The clearance between the pin and the hole in the bushing was 0.002 inch.

Time in Thousandths of a Second

Bushing No.	Operator No.	T_{TL}	T_P	T_{TL+P}	T_{A+DA}	T*
1	1	397	244	641	189	830
	2	264	235	499	215	714
	3	277	308	585	180	765
	4	299	343	642	178	820
	5	272	254	526	202	728
	6	326	251	577	171	748
	7	340	333	673	195	868
	Average	311	281	592	190	782
2	1	383	417	800	168	968
	2	262	307	569	228	797
	3	395	290	685	174	859
	4	245	305	550	183	733
	5	284	263	547	190	737
	6	285	291	576	160	736
	7	272	414	686	186	872
	Average	304	327	630	184	815
3	1	536	178	714	169	883
	2	257	225	482	199	681
	3	391	257	648	167	815
	4	294	290	584	180	764
	5	351	252	603	185	788
	6	249	417	666	161	827
	7	352	414	766	193	959
	Average	347	290	638	179	817
4	1	415	195	610	189	799
	2	265	346	611	185	796
	3	354	427	781	189	970
	4	437	215	652	158	810
	5	392	340	732	159	891
	6	351	263	614	153	767
	7	371	276	647	197	844
	Average	369	295	664	176	840
5	1	430	452	882	139	1021
	2	271	613	884	156	1040
	3	541	438	979	181	1160
	4	414	534	948	82	1030
	5	372	469	841	78	919
	6	314	445	759	136	895
	7	346	441	787	160	947
	Average	384	485	869	133	1002

* $T = T_{TL} + T_P + T_{A+DA}$

After the pin was withdrawn from the hole, it was carried away from the operator and dropped into a bin, *G*, in the table top, the hand continuing on to the magazine to grasp the next pin and so beginning another cycle.

Thus $T_{TL+RL+TE}$ on line *A* was a measure of the time to transport (*transport loaded*) the pin to the bin, release it (*release load*), and move the hand (*transport empty*) on to the magazine.

The sequence of motions for one cycle of the operation, with names of therbligs and the time shown on Figure 3, was as follows:

1. Remove one pin from magazine at *B*—*grasp*—T_G,
2. Carry pin to edge of bushing at *C*—*transport loaded*—T_{TL},
3. Place pin in hole, *E*, of bushing, *D*—*position*—T_P,
4. Move pin down into hole, *E*—*assemble*
5. Withdraw pin from hole, *E*—*disassemble*

} T_{A+DA}

6. Carry pin to hole, *G*, in table—*transport loaded*
7. Dispose of pin—*release load*
8. Move hand to magazine, *A*—*transport empty*

} $T_{TL+RL+TE}$

Procedure—Seven operators were used on each of the two parts of the study. They were instructed to grasp one pin at a time, carry it to the hole, turning the pin perpendicular by the time the hole was reached, insert the pin into the hole as far as it would go, withdraw it, drop the pin into the bin provided, grasp another pin and repeat the cycle until the magazine was empty. Each subject was asked to do the task as rapidly as he could.

Previous to recording the data on the kymograph, each operator practiced 100 insertions with bushing No. 5. He then practiced 30 insertions with bushing No. 1, and the next 10 insertions were recorded without the

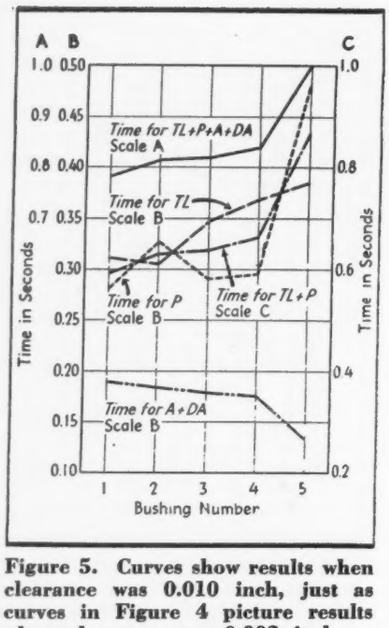


Figure 5. Curves show results when clearance was 0.010 inch, just as curves in Figure 4 picture results when clearance was 0.002 inch

operator pausing. The procedure for bushing No. 1 was repeated with bushings Nos. 2, 3, 4 and 5 and again with 5, 4, 3, 2, and 1 in that order. The data from 5 consecutive cycles from each set of 10 were analyzed.

Results—The median value of the time required by each operator working with each bushing was selected by the total of the time for the *transport loaded, position, assemble,* and *disassemble* therbligs. Since there were ten analyzed cycles for each operator with each bushing, this necessitated averaging two cycles to obtain the median. The median value was used in preference to the average because the operators were only partly skilled and the median would be less affected by isolated extremely high or low values. Tables I and II give a summary of these data, and the curves in Figures 4 and 5 show the results graphically.

Conclusions

Part A—Clearance between the pins and holes was 0.002 inch.

1. Total time required to carry a pin to the bushing, position, insert, and remove it, increased as the amount of bevel surrounding the hole in the bushing decreased from 45 (No. 1) to 0 (No. 5) degrees.

2. Sum of the *transport loaded* and *positioning* times increased as bevel decreased. Time to carry pins to bushing and position them was the least for bushing No. 1. It took 6 per cent longer for bushing No. 2, 8 per cent longer for No. 3, 12 per cent longer for No. 4, and 47 per cent longer for bushing No. 5 than for No. 1.

3. Sum of *assemble* and *disassemble* times decreased as the bevel decreased, even though the length of the bearing surface (the ¼ in. bore) was not increased except with hole No. 5 which had no bevel.

4. It appeared as though the times for *transport loaded, position, assemble,* and *disassemble* were interrelated, each of the last two being affected by the speed of performance of the therbligs preceding it.

Part B—Clearance between pins and holes was 0.010 inch.

1. Total time decreased as amount of bevel surrounding decreased from 45 degrees (No. 1a) to 34 (No. 2a), and increased as the bevel decreased from 34 degrees to 0 (No. 5a).

2. Sum of times for *transport loaded* and *positioning* decreased as bevel decreased from 45 degrees to 34, and increased as the bevel decreased from 34 degrees to 0.

The time to carry the pins to the bushing and position them was the least for bushing No. 2a. It took 2 per cent longer for bushing No. 1a, 14 per cent longer for No. 3a, 19 per cent longer for No. 4a, and 70 per cent longer for bushing No. 5a than for bushing No. 2a.

3. Sum of times for *assemble* and *disassemble* tended to decrease as the bevel decreased from 45 degrees to 0 even though the length of the bearing surface was not increased except with bushing No. 5a which had no bevel.

(Acknowledgment is made to Marvin E. Mundel, research assistant in mechanical engineering, who carried on the studies described above. Professor Barnes's second article will appear in March.)

TABLE II — RESULT SHEET

Medians selected by total of time for transport loaded, position, assemble, and disassemble for seven operators. The averages of the medians are also shown. The clearance between the pin and the hole in the bushing was 0.010 inch.

Time in Thousandths of a Second

Bushing No.	Operator No.	T_{TL}	T_P	T_{TL+P}	T_{A+DA}	T*
1a	1	419	87	506	202	708
	2	356	118	474	224	698
	3	373	191	564	240	804
	4	279	228	507	206	713
	5	283	207	490	233	723
	6	362	144	506	123	629
	7	296	162	458	173	631
	Average	338	162	501	200	701
2a	1	275	198	473	193	666
	2	242	169	411	223	634
	3	361	141	502	239	741
	4	286	193	479	233	712
	5	325	210	535	141	676
	6	420	159	579	141	720
	7	325	127	452	179	631
	Average	319	171	490	193	683
3a	1	278	302	580	110	690
	2	322	185	507	216	723
	3	248	354	602	222	824
	4	326	174	500	184	684
	5	393	180	573	200	773
	6	303	248	551	183	734
	7	407	178	585	245	830
	Average	325	232	557	194	751
4a	1	311	281	592	125	717
	2	177	388	565	217	782
	3	383	196	579	228	807
	4	375	153	528	212	740
	5	373	196	569	185	754
	6	390	192	582	97	679
	7	478	178	656	127	783
	Average	355	226	582	170	752
5a	1	471	313	784	50	834
	2	369	336	705	234	939
	3	614	402	1016	200	1216
	4	315	519	834	74	908
	5	320	462	782	84	866
	6	342	437	779	130	909
	7	575	347	922	74	996
	Average	429	402	832	121	953

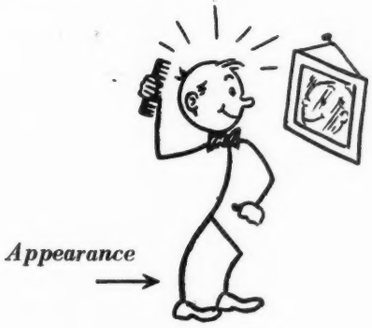
* $T = T_{TL} + T_P + T_{A+DA}$

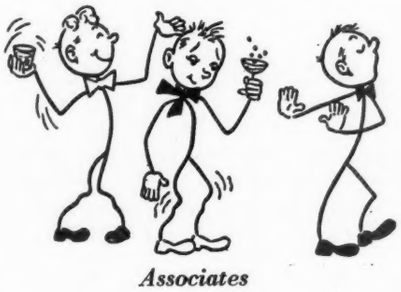
THE ABC's OF PERSONNEL

CHARLES S. STEVENSON
General Manager, Hall Brothers, Inc.
Kansas City, Mo.

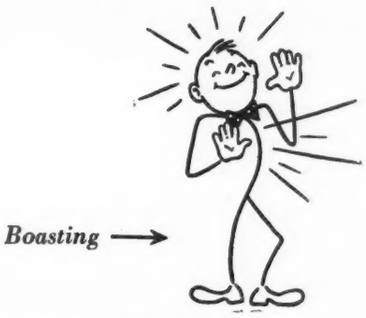
Charles Stevenson, who contributes these alphabetic tips on how to handle people, learned his own ABC's as a top kick in the late War—to which he has added service as stock boy, order clerk, shipping clerk, maintenance manager, employment manager, operating manager, purchasing agent, and personnel manager of a large greeting card concern. Today as general manager he knows each of several hundred men employees—and most of 400 women and girls—by their first names.

Alphabetic tips for those that have to handle people—by an old hand at the business. If you are on the way up, read thoroughly. If you have already arrived, read thoroughly. Next month, the C's and D's





Associates



Appearance

OVERHEARD: "The other night Joe, the boy friend, and I pass the boss at a show . . . 'Whosat?' Joe says. 'My boss,' I yelp. 'Looks to me like he forgot to come in out of the rain,' Joe shoots back. What could I say, 'cause that's exactly what he looked like!" . . . Can anybody be saying anything like that about *you?* Your employees like to see their leaders well dressed . . . running around with garters down, needing a haircut, wearing frayed shirts or sport shoes run down at the heel may be economy, but it's not good business. And come to think of it, how did the man just above you look today?

Associates

CHOOSE THEM WISELY and well! You just can't afford to be seen with the wrong people. Joe Harvey, purchasing assistant, didn't know he lost the P.A.'s job because he was seen several evenings having too good a time with the fellow from whom he purchased printing. Sure, it was unfair . . . all wrong . . . they both said there wasn't any obligation at all . . . just good fellowship. But good old Joe is still the assistant! A manager, a foreman—in fact, any leader—is judged by those above him and those below him. The wrong associates can weaken your chances of progress with your superiors and destroy the faith of your followers.

Balance

"MOST WIVES want a good lover, a successful business executive, and a capable maintenance man for a husband," said a humorist. In husbands that would be *balance!* Having balance in handling people with whom you work is of utmost importance . . . as a leader you can't be in a good mood just every *other* day . . . *every* day isn't enough some times. The man with balance turns out a good week's work 52 times a year! Does the boss have to make a note to check the completion of a job he gives you? If some overtime is necessary, is he uneasy about your answer? Can you differentiate between trifles and otherwise? Is your reasoning impersonal? If you have balance, you have nearly everything!

Boasting

BOAST . . . brag . . . bluster . . . a triple threat to your future! Shakespeare said in Henry V, "The empty vessel makes the greatest sound." The bard of Avon knew what he was talking about. Telling of your past accomplishments is music to your relatives only; forecasting your future conquests is dangerous; and either puts you in a bad light with your coworkers. Don't hide your virtues under a basket . . . but don't get mistaken for one of Shakespeare's empty vessels. Somebody might accidentally want to find out what's really inside.

52 Pay Checks a Year

Regular weekly incomes. More job security. Less hiring and firing. Those are the important benefits employees get from Sears Roebuck's new standard income plan—which, as usual, works both ways. It costs the company less to hire, less to train, and less to operate

ARTHUR VAN VLISSINGEN
Consulting Editor

PUBLIC RELATIONS
Industry's Biggest Job

IT IS THE NEAREST approach we have ever discovered to giving the employees their cake and letting us have our cake, too," is the way an operating executive of Sears, Roebuck & Company describes his firm's "Standard Income Plan."

Because the company's business is predominantly concerned with distribution, it would be plausible for a production executive to dismiss this experience with, "Oh, our business is different." By so doing, he would be saving himself the effort of comprehending the Sears plan, but at a cost of missing an idea that applies just as directly to most manufacturing enterprises as to the Sears type of activity. In brief, if it works at Sears, the chances are it might work just about as profitably in *your* plant.

So far, it has been used in seven of the ten Sears mail order plants, and nowhere else in the organization. Despite the fact that it is essentially a merchandising establishment, a mail order plant is much like a typical manufacturing plant. Raw materials are its incoming goods. The work it performs is to put them into stockrooms, then assemble from these stock units the individual orders that come in from mail order customers. In doing this work, the plant necessarily performs a tremendous grist of paperwork, a huge volume of materials handling, and a good many production operations such as wrapping, weighing, labeling, and stamping.

Labor required varies greatly in experience, physical strength, sex, age and mentality. Volume of work shifts by day of the week, by weeks, by seasons, and by general business conditions. If anything, it should be more difficult to apply an annual salary plan to such a working force than to the force of a factory where shifts of volume are principally seasonal and cyclical.

The mail order business has essentially the same problem as the automobile maker that schedules so many finished cars per hour, or the canner that schedules so many thousand cases per day. Changes in production schedule necessarily increase operating costs. Some employees must be shifted between schedule and nonschedule work. Others must be hired or laid off, with consequent costs of training and employment. On the other hand, for a mail order house to adopt a standard production schedule per hour, subject only to change during vacation periods and the late fall and Christmas peak, means that in some weeks the employees get in very short hours.

What the standard income plan accomplishes from the employee's standpoint is that it gives him a regular weekly income 52 weeks a year, in exchange for which he works whatever hours are required of him in any given week up to, but not beyond, reasonable maximums. Thus, in the first three weeks of December he is likely to work 9 hours a day. But

Sorting—the first operation in shipping mail orders. Here is proof that this business isn't so different from manufacturing. We see the same familiar equipment—the roller conveyor, the moving belt that brings packages to the sorters. In short, if the standard income plan works for Sears, there is a chance that it will work for manufacturing plants

when volume falls off between Christmas and New Year's, and at other low-volume periods during the year, he is just as likely to work 6 hours or 7 hours on several days a week with Saturday off.

He knows he will have to work approximately 2,010 hours during the year, which is 52 weeks of 41 hours, minus 82 vacation hours and 40 holiday hours. And he knows further that, at the end of the year marking the installation of the plan, the timekeepers will strike a balance for him. If he has worked more than 2,010 hours, he will be paid for the excess at his regular hourly rate. If he has worked less than 2,010 hours (any shortages arising from his voluntary absences have, of course, been adjusted by deductions during the year), the shortage is simply written off by the company as its loss.

In other words, if he works more than the required hours, he gets paid for them; but if he works less, it does not cost him anything. If the employee comes under a wage incentive plan, the credited hours under the standard income plan are the hours actually worked, and his bonus is paid currently as he earns it.

Job Security

As a final advantage, the employee has greater job security because there are fewer organization reductions. It is worth keeping in mind, however, that the employee is not guaranteed job tenure because of the standard income plan. Obviously, if 1938 should produce only 80 per cent as much business as 1937, there would have to be a reduction in employment from circumstances beyond the management's control. The employee is, however, guaranteed 52 weeks of 41-hour pay if he holds his job. And if he should be dropped while he has an overage of hours, he would get a cash payment for the amount, whereas if he should have a deficit, this would be written off without effort to collect from him.

From the management's standpoint, the standard income plan has just as important advantages. It decreases training expense because it cuts down drops and hiring. There has certainly been a saving through fewer quits, although this cannot be measured under current conditions. Likewise, there has been an improvement in the quality of work due to a better trained and more stable organization.

"We know there has been some improvement in our turnover," comments a Sears operating executive, "but feel that we have not yet attained all the benefits made possible by it. We have been following through on a program to give our employees additional inter-activity training so that as volume tapers off in one department and increases in another, the employees can be switched provided the job requirements match up as to sex, physique, age, and skill. The provisions of the social security laws make this program all the more important from a cost angle, although we have felt it is fully warranted alone from the standpoint of employee job security and improved employee relations."

Planning the Work

In five Sears mail order plants the plan operates over a 12-month period which usually terminates at the end of the spring fiscal season in July. Employees are paid every week for the same number of hours regardless of hours actually worked. A progressive record is kept on each employee showing cumulative hours paid and worked. It is necessary to plan the work currently to keep individual cumulative hours reasonably well in line with the estimated working hours, which are budgeted in advance for each activity (not for each employee) and which allow for the seasonal volume trends.

It is a responsibility of the plant management to come out even at the end of the year. Any lump sums for surplus hours are therefore a loss on the plant record. The largest source of loss so far incurred is from overestimating the future volume of work in scattered activities throughout the plant.

A second source of loss comes from quits in an off season where deficits are piled up; there is no indication, however, of a tendency of employees to quit in order to walk out from under the deficit. A third source of loss is when a wage increase intervenes and the employee's surplus hours are paid at the new rate at the end of the plan year; the practice is to pay him at the higher rate. All told, experience indicates that the maximum loss on gross payroll under the standard income plan is about one-half of 1 per cent.

The Two-Plant Plan

By reason of customer buying habits the trend in two of the Sears plants is toward lower peaks and shallower valleys. So, in these two plants, surplus hours are not piled up on the books, but are paid for in cash just as soon as the employee turns the corner. That is, after the employee has incurred a deficit of hours, and then has made these up during the busy season, his surplus hours are not carried over to another dull season, but are paid off in cash every week. This two-plant plan is a continuous plan; it has no annual cut-off or settlement date as in the other five plants where fluctuations of volume are more extreme between the spring and fall seasons.

There is no illusion at Sears that the standard income plan is a cure-all for the ills of operating or of industrial relations. Company executives recognize from experience that the details of the plan require a lot of follow-up during its first year. Thereafter, they add reassuringly, it is almost as easy to operate as the old catch-as-catch-can method. But during the days of learning how to make it work in a given plant, there come little catches and wrinkles to be ironed out.

For instance, it is simple to transfer the toy department people from the Christmas peak over to the wearing apparel activity that builds up for Easter. But how are you going to use the mature male worker from farm implements on light work requiring a delicate touch—say picking orders for silk hosiery—when farm machinery hits its annual slump in the late autumn?

The problem is made more complex because the farm implement man is typically a head of a family, and by company policy his job must be safeguarded by any extreme of ingenuity. In short, while you are planning your total production schedule for the plant, you must also take into account

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INDUSTRY'S 1939 PROGRAM

Adopted last month by the National Association of Manufacturers at its Congress of American Industry

W. L. BATT

President, SKF Industries, Inc.
Philadelphia

Mr. Batt, who as Chairman of NAM's Resolutions Committee presented this program, is a member of Business Advisory Council. He is also President of the International Committee of Scientific Management, and will continue to hold that office until the conclusion of the Eighth International Management Congress, to be held in Sweden in 1941. He was Chairman of the Coordinating Committee that directed the Seventh International Management Congress held in Washington last September.

1. Business Responsibility

Business men generally are aware that their human responsibilties include the operation of business with regard for the best interests of customers, employees, and stockholders, and with recognition at all times of the rights of the public. Such policies contribute to understanding, promote harmony and thus tend to increase jobs and raise living standards. Industrial management should therefore—

1. Interest itself actively in the economic and social needs of the times; present suggestions to meet the problems involved; and tell the story of industry's views and accomplishments to the public.

2. Publish frequently simple and informative statements concerning financial and other operations, in order to interest both employees and stockholders more directly in company problems and operations.

3. Consistently maintain quality standards; develop and improve products offered by means of market research, technical research and experimentation; make price adjustments as rapidly as improved manufacturing processes and other economies will permit without injustice or injury to employees, creditors, and owners, including stockholders.

4. So manage its financial, inventory, and customer credit policies as to effect the maximum volume of production, distribution, and employment that can be maintained continuously.

5. Maintain sound relations with its employees as set forth in the following section of this program.

6. Conduct its business so that it is at all times a desirable citizen of the local community in which it operates.

7. Encourage effective functioning and cooperation of associations to consider community, state and national problems.

2. Labor Relations

Industry recognizes mutually satisfactory labor relationships as an essential to industrial efficiency and to the providing of more jobs and better living.

Industrial management recognizes that employees who wish to bargain collectively are entitled to do so, in whatever form they determine, through their own freely chosen representatives, and without intimidation or restraint from any source.

The disturbed labor relations which have existed during the past few years are a major obstacle to recovery. Industry pledges its full cooperation in whatever changes may be necessary to correct these conditions.

In order to promote mutually satisfactory labor relations which will increase production and provide more jobs, we urge employers to maintain a well-defined labor policy suitable to the conditions of the company, community, and industry; to provide opportunity for free interchange of ideas between management and employees on all matters of common interest, adequate opportunity for prompt consideration and adjustment of complaints and fair wages for work performed, with incentives where they can be fairly applied as a reward for individual or group accomplishment; to maintain good working conditions.

Constant improvement of the methods of production creates jobs. Industrial management should endeavor to cushion the effects on individual employees of the introduction of new processes and labor-saving machinery; management and labor should cooperate in using every practicable means to provide continuity of employment, and should study the annual wages of employees in relation to their hourly earnings and the number of days per year the plant operates, including careful consideration of the effect of hourly rates upon continuity of employment and income.

3. Tools for More Jobs

The tools and machinery to work with must be bought with savings. On the average there is an investment in manufacturing of $6,500 back of each worker. For over 100 years in our American system of private enterprise the major source of such funds has been savings of business, and the source of next importance has been savings of individuals.

These investments have made men's efforts vastly more productive, by furnishing the aids which science, invention, and engineering have made possible, through better tools and power equipment. Such tools and equipment constitute a substantial part of the privately owned wealth of the nation.

Saving and investment constitute the keystone to private enterprise. Anything that controls or limits these processes will eventually control and limit private ownership and use of property, and will fix the underlying

(Continued on page 110)

Left to right, at Congress of American Industry (Dec. 7-9), Charles R. Hook, ARMCO and NAM President; Dr. George Gallup, Director, American Institute of Public Opinion; William B. Warner, President, McCall Corporation, and Chairman of the Board, NAM; C. M. Chester, Chairman, General Foods Corporation, and Chairman, NAM Executive Committee

MAKING AMERICA CLICK

High lights from the keynote address of Charles R. Hook before the Congress of American Industry—followed by excerpts from seven other papers of special interest to plant-operation men

INDUSTRY SEEKS the cooperation of all the elements of our society—the public, agriculture, labor, and government—in supplying the missing link to produce prosperity in this country. That link is *confidence.*

Good times have been obstructed by class cleavage. Our good neighbor policy must start at home if we are to recapture American progress. We've got to do something about it.

1. Let governmental and industrial emphasis be placed on increased production, for it is the total production of goods and services which determines the standard of living. Real increased national purchasing power can be based only on increased production, and not artificially created by artificially fixing prices, by artificially supporting wage rates, or by the distribution of group subsidies.

2. The constant encroachment of government competition upon private enterprise must be eliminated if we are to create that confidence which is essential to the flow of corporate and private savings into production and trade.

3. Our present tax structure and our taxing methods are in need of a complete overhauling. Because the tax problem is so involved, I suggest that the President appoint a commission of qualified legislators and informed laymen to study the entire field of taxation. A little less emotional and a more practical approach to the problem is imperative if, as a nation, we are to escape serious trouble. The growing tendency to employ the taxing power for regulatory rather than revenue purposes is unfortunate and ought to be abandoned.

4. We need in the United States a national labor relations policy based on the American conception of fairness and commonsense—a policy that encourages industrial peace and discourages the use of force and arbitrary methods. And even more—much more—that needing laws, we are in need of better understanding. Take compulsion and coercion *from any source* out of industrial relations, and long steps will be taken in the direction of industrial peace.

5. Give American business a chance to operate under a Square Deal. To make America go ahead we've got to get our

9,000,000 unemployed back to work. We cannot regain prosperity until we do. That was apparent in 1933; it is equally apparent now.

Today's industrial management has learned that there must be a free interchange of ideas and information between management and employees on all matters of mutual interest; that adequate opportunity for adjustment of all labor complaints is necessary; that good working conditions, fair wages, and opportunity for advancement are of the utmost importance.

Our goal is a better America—a decent standard of living for all its citizens. That objective will not be attained by taking away from those who have and giving to those who have not. It can only be reached through increased production—through the clicking of all the factors operating in a democracy under the incentive or profit system.

Your Partner, the Public, Must Know

DON FRANCISCO
President, Lord & Thomas

ONE of the forces that made America great—the forces of industry here represented today—is a force that nobody knows. People have been too busy enjoying its benefits to understand its origin and purposes—too interested in capitalizing their opportunities to consider how it worked, and industry has neither understood nor undertaken to inform them. Furthermore, industry has not always positioned itself to meet the public demands. Thus the people have listened to other doctrines, not because they necessarily offered more, but for lack of understanding of what they had.

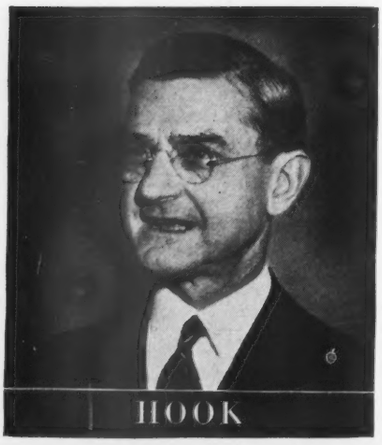
Ours is still the greatest nation on earth. With all our troubles we are the envy of the world. Who among us would live elsewhere if he could? What untold millions would live here if that were possible?

The remedy for our ills lies not in abandoning our basic formula, but in correcting its faults, making it work better, and making it better understood.

The objective of each business should be to merit public support and then go out and win it.

When the force that nobody knows becomes the force that everybody knows—then we will have helped to "Make America Click."

What is needed now is many individual programs sponsored by our leading industries to interpret themselves to the public and to use their specific accomplishments to prove our main theme. Only when we talk about specific industries can we use specific facts and deal with specific criticisms. Only when we talk through specific industries can we prove our main theme. What people think of industry in general is largely what they think of its component parts.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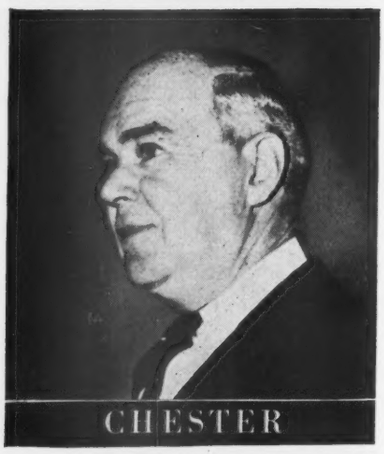

CHESTER

HAWKES

Shake Hands with Tomorrow

C. M. CHESTER
Chairman, General Foods Corporation

CAN BUSINESSMEN put people back to work, open the door of tomorrow for the thousands of young men and women graduating each year from school and college; see to it that living levels are raised, that many more people shall have many more of the good things of life?

I don't know that I can qualify as a witness, certainly not as an expert, but it so happens that I have had a chance to make a mental Gallup poll of what American management really thinks, what its objectives are, where its hopes and ambitions lie. And I wonder if the people realize what I found—that we have a new type of industrial leadership as compared with 20 or 30 years ago.

There are some throwbacks, of course. All business leaders are not perfect. Who is? But there is among them a surprising amount of what might be called humanitarianism.

Now there are all kinds of humanitarianism—some utterly selfish, some impractical, and some possibly just political. What we are talking about is practical h manitarianism, in which one human seeks to do what he can for his fellowmen, in a sane, sound, sensible way.

The practical humanitarian knows that it is impossible to improve the welfare of all Americans by simply decreeing that it shall be so. He wants to lift up those of our citizens who have the least purchasing power at present. But he knows that simple division of what we already have won't do it. Nor will lowering our level of national living provide the answer. The practical humanitarian wants to create more; to get more purchasing power and more goods into the family instead of just dividing up what we already have and calling it a day. The special birthright of each generation of Americans is to move on to newer heights.

Research: Increased Asset for National Progress

WILLARD H. DOW
President, Dow Chemical Company

FROM THE STANDPOINT of management, it is ever more imperative that research shall keep within reasonable bounds and that it shall comprehend, preferably, those sources of materials which are more readily available. The closest research surveillance is demanded for every item we make. Even though we have, let us say, a 100 per cent production efficiency, it is still our job to determine ways and means whereby we fortify our future operations . . .

Research of any kind has a vital cumulative effect and it is obvious, therefore,

that the prosecution of research must be maintained through good times and bad. The essence of productive research is continuity of research.

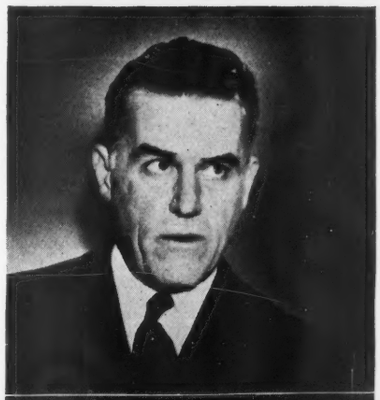
Research must be regarded as an investment for the sake of future benefits. From the investor's standpoint, the financial man always wonders how soon he can expect a return from the money spent on research problems. In some instances, which are very rare, research may show a return during the first year. A number of years ago it was estimated that a period of at least five years would elapse from the idea to the dividend. The general impression among most industrialists today seems to be that there is an even greater lag, possibly as much as seven years between test-tube and dividend.

In the United States our greatest developments undoubtedly have taken place in mass production; our capabilities are most developed in this direction. For that reason there is apt to be a lack of sufficient amortization on the investment to justify all new improvements. This possibly is our greatest single handicap; and, while we are confronted with amortization problems, more aggressive competitors, both at home and abroad, are often able to upset our financial picture. We are subject to criticism for our inertia against change.

We have as brilliant scientists in our country as exist in the world, but at the same time it must be admitted that the majority of basic fundamental discoveries have been made in greater numbers by countries other than our own. It behooves us, therefore, to weigh well the success that has crowned our efforts in the commercialization of inventions. World progress henceforth demands that there be less resistance to innovation, and more abundant foresight.

From the public standpoint, there is nothing more desirable than an assurance from management that immediate translation into production shall follow each and every discovery and invention. Each new idea should be given every encouragement in order that the new industries likely to spring therefrom shall ever constitute a step from which to ward off financial depressions.

DEUPREE



MOORE

PRENTIS

COONLEY

Equity for Labor and Capital

A. W. Hawkes
President, Congoleum-Nairn, Inc.

I RECOMMEND that every manufacturer who is interested in the continuance of our enterprise system and our form of government make it his business in the future to do the following things:

1. Regardless of fine wages, working hours, and other conditions, wherever the size of the company permits, see that at least once a year all the employees of the company have a chance to look at you or some of the upper officers to see that you do not have horns. In large companies, I recommend the heads of the subsidiaries or plant divisions carry this policy into effect.

2. If your company policies do not square with the progress of human relationship in this country, then square them as far as is possible, based on sound economics, and make it your business to see that your men understand them.

3. Don't mislead your employees by bidding for popularity through doing the unusual or economically unsound thing which cannot last and which damages not only the company that tries it but all industry—because human beings still relate and compare what happens to their neighbors with what happens to them.

4. Be sure that no superintendent, foreman, sub-foreman, or supervisor attempts to be sharp or shrewd in dealing with the man-power of the company.

5. Be certain that no man between you and the men down the line, breaks the chain because he misunderstands the company's policy or fails to carry through the instructions of management.

6. The definition of a corporation in the past has been, "an invisible, intangible being, exsiting only in contemplation of law, without heart and without soul." We must prove that a corporation can have the equivalent of a heart and a soul, and that the representatives employed to direct its affairs serve as an agency of human beings—if it is to remain a useful agency for the conduct of business.

7. Have your men in the plant understand that the laborer of today is the potential capitalist of tomorrow. That his interests of tomorrow may be identical with others of today, and his acts of today should be so measured that he will be willing to have similar acts from others tomorrow.

New NAM President is Howard Coonley, Chairman, Walworth Company

The Importance of a Steady Job

R. R. Deupree
President, The Procter & Gamble Company

STABILIZED employment is one of the great needs of American industry. Any business which can work out a plan whereby its employees are given steady work, realizes regular production economies. A man improves on the job—and oftentimes he improves his job when he works steadily. But this immediate savings is only one thing; the long-term benefits are just as marked. Steady work makes satisfied workers and no one can underestimate the importance of that fact

today. I consider the most important thing that we have to do in our relationship with our employees is to assure them steady work.

Pension plans, profit sharing, sick benefits, Christmas baskets, and all, are important, but nothing takes the place of a steady job.

It is a fact though that throughout this country there are many plans in operation today, all of them, as far as I know, different, yet all of them pointing to the same objective—namely, steadier employment. It is because of my work during the past six months with the Committee of the Business Advisory Council dealing with this subject that I do not like to generalize or to lay down any act for all industries. I only want every one of you to realize that the companies which have spent time, effort, and money to plan for steady jobs for their employees, have, in every instance I have known, found it to be a sound investment. So far as I know, each and every manufacturer is satisfied that his plan is not too costly when he considers the ultimate results—namely, steady income for his employees.

Profit Sharing*

ROY W. MOORE
President, Canada Dry Ginger Ale, Inc.

THE THEORY advanced to justify profit sharing from an economic standpoint is that wages should be related in some way to profits earned; that it is impossible to predict in advance either total output or total profits; that it is, therefore, impossible to fix wages in advance so that they will be related to profits, and that the only feasible means of establishing such relationship is to give the workers a share of the profits.

It is our feeling, however, that it is impossible to advocate profit sharing for industry as a whole since conditions in different companies and industries differ so widely. In many cases profits fluctuate so widely that the result of any universal adoption of profit sharing might eventuate in wide disparities in payments to workers who do exactly the same work and contribute exactly as much to the output of their respective companies.

We believe, however, that each manufacturing company should carefully consider whether any profit sharing plan is feasible or practicable in the light of its own conditions.

It is our observation that profit sharing is most suitable when companies have had fairly continuous profits over a period of years.

The opinion is likewise advanced that it is difficult to establish profit sharing on a firm basis unless the production and employment of the company is fairly well stabilized. . . Profit sharing will work best where there are also wage incentive plans, with wages based on either individual or group production, so that the profit distributed to the worker is directly related to his own efficiency as reflected in his total compensation.

From an economic standpoint, profit sharing can be equitable only when both employer and employee realize that the basic wage rates should be related to both productivity and selling price to consumers.

Profit sharing plans can, moreover, be successful only if employers do an intelligent job of explaining to employees why profits are not earned in some years.

* *From Mr. Moore's address, "Treat Both Sides Alike," based on report of Employment Relations Committee.*

Open House at Warner & Swasey

For those about to try out the "open house" technique of public relations, the experience of Warner & Swasey, Cleveland, is to be recommended. The open house this company concluded early last month was in many respects similar to its 1937 affair and followed the pattern now familiar to most plant-operation men—with two rather important exceptions, which could quite easily be incorporated into many another concern's program.

The first was a hobby show; the second, a 10-point company questionnaire. The latter included simple questions like "The company was founded in what year? (Visit the 3rd floor)." Prizes were awarded for the best answers. Thus visitors learned facts about the company and its products, and were also encouraged to make their visit a thorough one. As for the hobby show, who *doesn't* like a hobby show?

It rained cats and dogs all day, but 10,500 people came just the same.

Industry's Program

H. W. PRENTIS, JR.
President, Armstrong Cork Company

WHAT are industry's objectives for America? First on the list is more and better food, shelter, clothing, and transportation. But industry knows that a higher standard of living can be secured solely by the production of more goods and more services, by the opening of more factories and creating more jobs, not by legislation, by public charity, by redistributing wealth, or by wishful thinking.

Beyond material things, industry's objective is more education, more cultural opportunity, more leisure for everybody. It seeks, moreover, to help set up reasonable safeguards against the four spectres that haunt the minds of every human being—the spectres of sickness, unemployment, old age, and death.

Industry's goal for America recognizes that physical comfort is not enough; that no man lives by bread alone; that to be truly happy a man must have intellectual, political, and spiritual freedom. Hence industry's dream for America includes the preservation of our American system of private free enterprise at all hazards, because industry knows, as our forefathers knew, that free enterprise and religious and political liberty are inseparable. Together these three constitute the tripod on which human freedom depends for support. Undermine any one of the three legs of this tripod and freedom is destroyed.

The objective of a rising standard of material living does not blind American industry to the paramount importance of the precious values of individual liberty from which all progress springs. No government commission will ever write a great book; no committee of this Association will ever paint a great picture; no labor union will ever compose a symphony; no chamber of commerce will ever invent a radio, or conceive a theory of relativity, or compose a sermon that will move the minds and hearts of men. The individual, in the last analysis, accounts for all human progress.

So in respect to its objectives, industry finds itself in full agreement with other social groups and government itself—a high standard of living, the comforts of life widely diffused; reasonable opportunity to provide against the risks of human existence; education, culture, and leisure; the opportunity for self-expression, and the maintenance of political, economic, and spiritual freedom.

To attain these objectives will require the combined effort of government, industry, commerce, labor, and agriculture.

Yale & Towne's Seventieth

On its seventieth birthday, Dec. 16, the Yale & Towne Manufacturing Company did not stop with the customary cake and candles. Its "party" took the form of a company show at the Stamford Armory—a show in which each of the several divisions displayed its products. The Stamford Division was there with its imposing line of quality hardware, Philadelphia with hoists and power trucks, and so on. The oldest employee—67 years of service—was on the platform to get a watch. And the newest employee—hired that same day—was on deck as a symbol of all the Y & T employees to come.

Main dish of the birthday feast, however, was a brief address by President W. Gibson Carey, Jr. Judiciously seasoned with simple economic facts about the capital-goods industries, it gave "the folks" a clearer picture of what industry means to America—and, specifically, of what Yale & Towne means to the communities in which it operates.

We mention it all here because this is a technique that can readily be used wherever it is realized that "public relations is industry's biggest job."

Quick Ways to Profits

OPERATING SHORTS FOR OPERATING MEN

POWER AND LIGHT

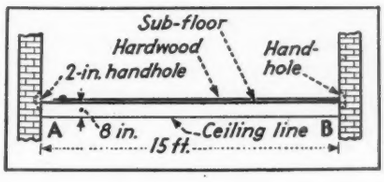
Mirror Shows Engineer Smoking Stack

SOURCE
Baldwin Piano Company, Cincinnati

Of course firemen in the boiler room have a periscope which shows them the degree of smokiness in the stack just above the breeching. But the engineer, whose office is one floor above, has quite as accurate a check on stack smoke. A mirror is set on the wall opposite his window and a few feet below. Its angle is such that it shows him the top of the stack. Thus he gets a direct reading by single reflection.

The outdoor mirror is necessarily set at an angle that causes it to accumulate dirt and snow. A man standing on the ground can easily remove snow. The dirt never gets so thick that it prevents accurate readings, and each rain clears the mirror's surface, so that there's never any difficulty seeing the stack.

From his desk the engineer can see the stack in the mirror



Flexible Steel Rule Serves as Fishline

W. A. BECK, *Bethlehem, Pa.*

Running new circuits in old buildings sometimes presents problems that are not readily solved by conventional methods. Such an instance came up recently when it became necessary to run a feeder under a floor suspended between solid brick walls, as shown in the sketch. The only access to the space between the floor joists was through two holes cut in the underfloor beneath the baseboard.

It was desired to run the feeder from point *A*, where there was an outlet, to *B*. Bricks at *A* and *B* were chipped away to provide additional space for fishing, but excessive chipping had to be avoided for fear of weakening the walls. However, the holes had to be large enough to permit the hands to explore the ceiling close to the walls, for the fishline.

It was found that the fishline when bent to curve under the floor could not be straightened out to make it travel the 15 ft. to the opposite wall. It curled more and more as it was advanced. A trial with the loom-covered cable showed that it behaved in the same way.

After the only result of repeated efforts to pick up the line was scuffed and bleeding wrists, it was decided to try a 6-ft. steel rule as a fishline. A flexible steel rule will tend to straighten out, if not restricted. Therefore, one was taped to the cable, eased through the handhole at *A*, and picked up at *B* on the first try.

Inserting blocks under a motor mounting will permit belts to run without danger of striking adjacent equipment from which clearance isn't great.

Check Wiring When Calibrating Instruments

S. H. COLEMAN, *Roanoke, Va.*

Instrument testing and calibration is at best a tricky business and unless every factor which might affect accuracy is closely checked there are possibilities of serious error. This is particularly true with electrical instruments, where plant alterations frequently necessitate changes in wiring or meter location. Since these changes may be made without the knowledge of the person responsible for instrument performance it is always advisable for him to check transformer ratios, shunt capacities, wiring polarities, and other items before calibrating the meter. Failure

to do this has often caused serious errors in the readings of presumably accurate instruments.

He should also make sure that when instruments are disconnected no other apparatus on the same circuits will be affected, and that there is no possibility of dangerous voltages. Current transformer leads should, of course, always be short-circuited before the meter is disconnected. Occasionally it happens that potential and current transformer leads are so arranged that inadvertent short circuits may cause trouble.

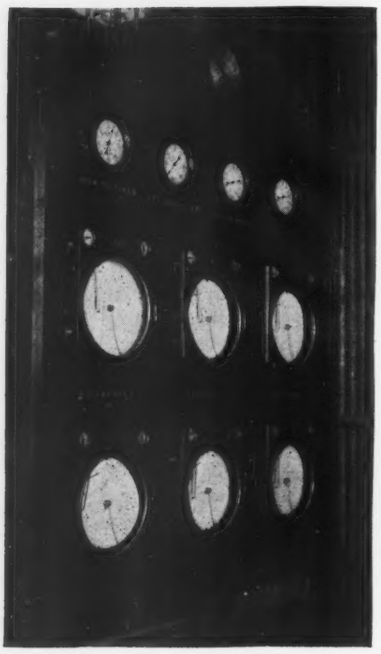
As a case in point, a screwdriver slipped when an electrician was disconnecting the current leads of a watt-meter, and made contact with the adjacent potential terminal. Due to an error in the wiring of the panel on which the meter was mounted, this contact allowed current from the potential transformer to flow through the trip coil of the feeder circuit breaker, causing a costly service interruption. If the panel wiring had been checked before starting to disconnect the meter, this shutdown could have been avoided.

•

Black Panel Makes Instruments Easy to Read

CHARLES C. LYNDE, *Kilgore, Tex.*

At the plants of Tide Water Oil Company's natural gasoline units, gages, recording charts, clocks, and all other instruments are mounted flush in black panels, treated to prevent sheen or reflection. Bright panel surfaces sometimes reflect light that interferes with readings. With a black panel set-up, only the charts and indicating dials seem to catch illumination, and their messages are instantly read. What each instrument is measuring is lettered in white just below, so that there will be no confusion of readings, and, when only one process or instrument is to be observed, readings can be made more quickly.

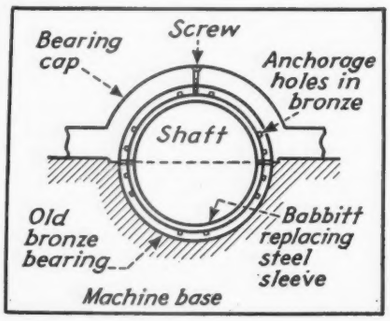


MECHANICAL POWER DRIVES

Babbitt Replaced Steel Sleeve on Old Shaft

K. B. HUMPHREY, *Sayreville, N. J.*

Two bearings 7½ in. in diameter, supporting a large gear wheel, had become worn to such an extent that it was decided to replace the bronze bushings. In order to get the old bushings out it was necessary to take the caps off and raise the shaft a few inches. Then it was discovered that a steel sleeve on the shaft had come loose and the shaft itself had become so worn that there was approximately



¼ in. play between the shaft and the steel sleeve. A new sleeve could not be placed on the shaft because it could not be fitted tightly.

In order to get the old sleeve off it would have been necessary to remove the gear, but after it had been decided to use a babbitted bearing the old sleeve was burned off. The shaft was ridged slightly in places, but on the whole was in fair condition, and smooth. The old two-part bronze bearings were removed and a number of holes drilled partially through them, to give a good anchorage for the babbitt.

In casting the bearings the old bronze was first put in place; then the shaft was lowered to the correct running position, leaving a space for the babbitt due to removal of the sleeve and wear in the bronze, of about ⅜ in. This space was babbitted with the shaft in place. The shaft was then raised slightly and the lower part of the bearing turned around the shaft so that it could be removed, after which it was scraped and fitted. The top half of the bearing was made in the same way, although two small screws were used in the cap to hold the old bronze tightly in place.

This method of procedure made possible a considerable saving in the cost of repairs since it was not necessary to disturb the position of the gear on the shaft, and the shaft had to be lifted only a short distance. The machine was quickly put back in service. A good grade of babbit was used, high in tin and specially designed for use in crusher bearings.

As a safeguard against fire in welding operations, sweep floors clean and dampen them before starting work.

Emergency Shaft Coupling Made from Rubber Hose

S. H. COLEMAN, *Roanoke, Va.*

When machinery breaks down and replacement parts are not immediately available, the maintenance department is often called upon to devise some temporary expedient in order that a prolonged production interruption can be avoided. A typical instance of this can be cited, where the flexible coupling joining the motor and fan of a blast heater used for process drying failed, in such a way that it could not be repaired. The time required to machine a new coupling or to obtain a spare from the manufacturer would have interfered with the completion of a rush order, resulting in a considerable loss of prestige for the company. The maintenance crew faced with this problem promptly removed the broken coupling, replaced it with a short length of heavy rubber hose, and put the heater back in service.

To do this, a section of hose having an inside diameter slightly less than that of the shafts was cut long enough to cover both keyways, and forced into place. Slots cut in the hose allowed the keys to be inserted, and the whole assembly was then tightly fastened on each shaft with a number of heavy hose clamps. This arrangement proved entirely satisfactory until a new coupling could be installed.

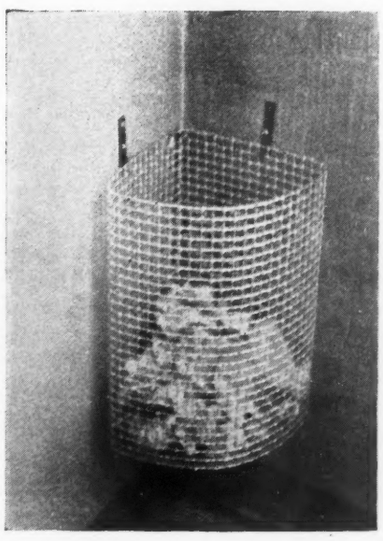
Stairway Waste Basket Reduces Sweeping Time

J. J. WENNER, *Williams Manufacturing Company, Portsmouth, Ohio*

We recently conducted a survey of our janitor service and brought a number of inefficiencies to light. On correcting these, and adding the impetus of a group bonus, costs for this service were reduced 12 per cent.

As an example of the type of inefficiencies uncovered, we found that several stairways were being swept down three times a day. Investigation showed that traffic on these stairs was no heavier than on others, but that these particular stairways were used by employees going to and from the plant lunch stand, located on the first floor. Sandwiches, cakes, candy bars, etc., are put in paper bags when sold, and employees going from the lunch stand to their workplaces, where they usually eat their lunches, were dropping these paper bags en route. Although a large number of waste barrels are to be found on every floor, the temptation to throw the paper on the stairs seemed hard to resist.

The photograph shows the special waste paper baskets, made in our own shops, which we installed on each stair landing to solve this problem. They are made of heavy-gage ¾-inch wire mesh, and, when filled, are carried down about ten steps and emptied into a truck. Since they are raised about 16 in. off the floor, they do not interfere with the sweeping, and their quarter-circle shape allows them to fit into a corner, occupying a minimum of space. Hooks on the walls hold the baskets in position.



As a result of this installation, we are able to get by with sweeping these stairs only once a day, thus reducing the time for this job almost two-thirds.

•

Centralized Mail Service Saves Confusion

JOHN F. PIERCE
Director, Office Service Department Tennessee Valley Authority

We used to have so many mail boxes that it was impossible to service them properly without a large force of messengers. Also, baskets were not labeled. Papers that were not intended to be mailed got into outgoing mail boxes, and were sometimes lost. It was all very confusing.

Investigation showed that many of these mail boxes could be dispensed with, and the mail delivered and picked up from a convenient centralized point. Centralization was especially desirable in some departments where the nature of the work made it desirable for someone to route incoming papers to those specifically allocated to that type of work.

The other thing we did was tag our boxes "Incoming Mail Only" and "Outgoing Mail Only." That has stopped the annoyance occasioned by putting papers into the box by mistake.

•

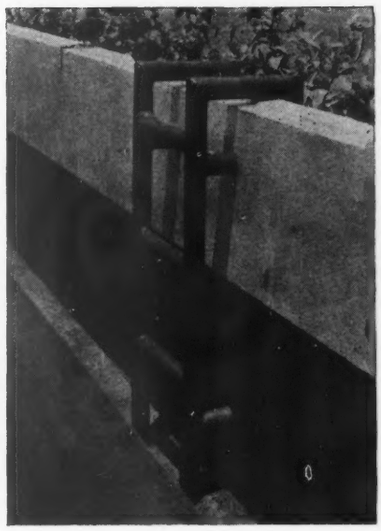
Back Spacers Make Safer Ladders for Pits

ELTON STERRETT, *Longview, Tex.*

Most concrete yard pits, particularly those containing equipment which must be serviced or inspected frequently, are provided with ladders. A common and very effective type is made from pipe welded into a solid unit, of the proper length to hook over the wall of the pit and reach to the bottom.

Such a ladder, if built to fit closely against the wall, offers little or no hand grip, and only a precarious toe-hold. If the hook portion at the top is made wide enough to permit the ladder to stand 3 or 4 in. away from the wall, there is always the danger of the ladder being pushed back against it with the result that fingers are mashed or the feet are knocked from a round.

A pipe ladder can, however, be made to hold tightly to the wall and afford ample foot and hand room, if



four short nipples of suitable length are welded to the back, to serve as spacers. The top spacers hold the outer ends of the hooks firmly against the wall, preventing sidewise slipping, while the lower pair maintain the desired clearance at the bottom of the ladder.

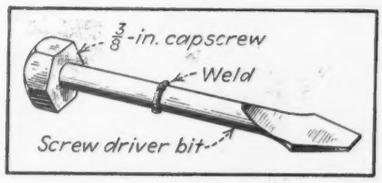
•

Here's One Way to Handle Hard-to-Get-at Screws

CARL O. LANDRUM, *Dumont, N. J.*

The screwdriver shown in the illustration will be a useful addition to a socket wrench set, or it may be used with an open-end wrench for tightening or removing stubborn or hard-to-reach screws.

As will be seen, a length of the bit from an ordinary screwdriver (a broken-handled one will do just as well) is welded to a cap screw cut to suitable length.



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Steel Drum Increases Safety When Scrubbing Floors

GEORGE A. HILBERT, *Ridgewood, N. J.*

When scrubbing the wooden floors in one plant is was formerly the practice to move a large barrel full of hot soapy water around on a flat truck. The barrel was not fastened down and several near-accidents oc-

curred when it accidentally tipped over.

Now a steel drum is used, lying on its side and fastened securely to the flat truck. A fairly large opening at the top and a large faucet at one end of the drum permit the hot water to be used with less spilling.

Hooks bent from scrap pipe and hung from ceiling joists are good ladder hangers, one company has found. They keep ladders overhead, out of the way, yet easily accessible.

Truck Outfitted for Emergency Service

NORMAN C. MÜLLER, *Oberlin, Ohio*

An outfit that has been very useful in emergencies around a large plant was made by mounting four 250-watt searchlights and a 1-kw., 115-volt, compound-wound d.c. generator on a small truck. The generator was mounted under the hod and driven by a V-belt from the engine. It was necessary merely to replace the regular fan belt with a longer one, to accommodate the lighting generator. The shunt field was connected through a switch on the dash of the truck. When the searchlights are needed the switch is closed, thus energizing the generator field. The searchlights are easily removable and can be carried inside a building or transformer vault.

In the truck are carried extension cords, fuses, small tools, first aid equipment, rubber gloves, a short hot-stick, and a portable telephone. The generator is of sufficient capacity to operate two of the lights and an electric drill at the same time.

In the event of fire the truck provides an auxiliary source of light so that the plant circuits can be killed to protect workers, firemen, and motors. A wet motor usually can be saved by drying it out, if it has not been energized while wet. Anyone who has ever held the nozzle of a fire hose when the stream hit a live line carrying as little as 115 volts can appreciate the advantage of being able to kill all electrical circuits during a fire.

The portable telephone has a straight line ringer; so it will ring on any frequency. When necessary it is plugged in on a line so that the crew can keep in touch with the office. Permission was secured from the local telephone companies to use this test set on their lines.

In one instance the men were able to do about two hours' testing in 15 minutes, by checking each operation by telephone.

•

Line Concrete Forms with Plywood

H. C. SLEMAN, *New York*

Finishing the surfaces of machine foundations or other concrete jobs requiring a smooth surface can be eliminated if the forms are lined with plywood. By using this material, which comes in large sheets and retains a great part of its strength even when sawed into complex patterns, intricate forms can be poured without leaving horizontal joint marks or ledges, common troubles experienced with unlined wood forms.

PUBLIC AND EMPLOYEE RELATIONS

Helping Employees Go to School

A. F. ERICKSON, *Works Manager*
All-Steel-Equip Company
Aurora, Ill.

It is the practice of this company and its subsidiaries to subsidize employees in learning trades and training for specific occupations. Several plans are offered and a limited number can enroll in each.

Plan No. 1. Young men from 18 to 22 years of age may learn a trade or train for an occupation by enrolling with the International Correspondence Schools and attending public school on Saturday mornings. They pay for the courses in cash or by monthly payments, but the company pays them at regular hourly rates for the hours spent in study. We call these indentured apprentices.

Plan No. 2. Under a cooperative arrangement with Armour Institute of Technology in Chicago, young men who can qualify and meet the requirements of the school, and want to work their way through school, work 8 weeks and go to school the next 8 weeks. We guarantee the weekly earnings to be not less than $15. This is a requirement set by the Institute.

Plan No. 3. Adult men in key positions and promising men among our employees are encouraged and subsidized to learn a trade or train for a specific occupation. To this end they may—

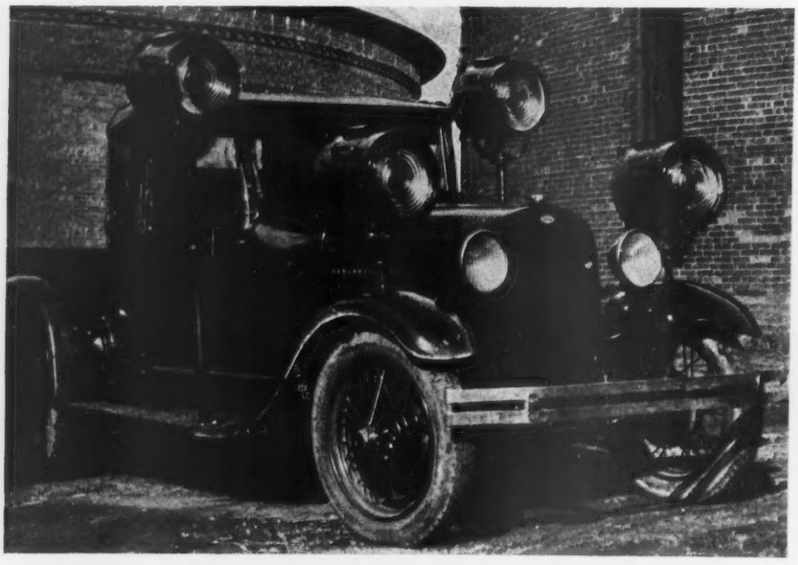
a. Attend Armour Institute of Technology in the evenings.

b. Attend Northwestern University in Chicago in the evenings.

c. Become International Correspondence Schools students.

d. Attend a local college.

The adult man enrolling for a course in the No. 3c plan is subsidized in the following manner. He enters into contract with the school for a certain course to be paid for in cash or by time payments. For each lesson the student completes, he receives a check from the company equal to or approximately 50 per cent of the average lesson cost. When finished with the course, the balance of the cost of the course is paid in a lump sum to the employee.



Searchlights on this emergency car can be detached, used inside a building

About 5 per cent of all our employees are subsidized under these plans. Because of the present adult education movement, our employees who are not subsidized are becoming interested in education. I estimate that there are as many students taking courses on their own as there are under the subsidized plans.

Benefits from this program may be summed up as follows:

1. Students become more efficient employees.

2. Trained men are ready when opportunities spring up within the organization.

3. Men appreciate the help given them and employee relations are bettered.

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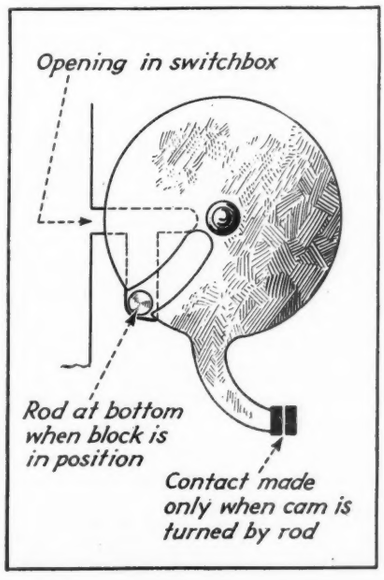


Cam Switch on Press Avoids Accidental Operation

R. A. SHAW, *Safety Engineer*
The Murray Corporation of America
Detroit

When repairs or adjustments are being made on power presses it is common practice to put a wooden safety block under the ram, to prevent injury to workmen by accidental operation of the press. However, if the ram descends while the safety block is in position breakage of some part of the press is almost inevitable. Hence, some positive means of preventing operation is necessary.

Various schemes are used for this purpose. We have developed and are using a switch which requires that a ½-in. T-shaped rod be inserted in the switchbox before the circuit can be completed. When the T rod is put in the operating position its weight turns a cam which makes the electrical contact, as will be seen from the illustration. The rod is attached to the top of a wooden safety block; therefore, it must be removed from the switchbox, thus breaking the circuit, before the block can be put under the ram.

No springs are used in these switches; so there is no chance of accidents due to breakage of a spring.

•

Two Schools—One on Wheels

SOURCE
Electro-Motive Corporation, LaGrange, Ill.

Training customers to service major equipment is a problem for many manufacturers. This company has worked out a satisfactory solution to this difficulty by establishing two training schools. One of these schools is comparatively conventional in type, the other highly unconventional.

The problem facing the company arose because diesel-powered equipment is sufficiently new on most railroads so that men in the road's maintenance forces are pretty much unfamiliar with it. Moreover, the railroads can not supplant old-time steam mechanics with new help skilled in diesels; seniority rules stand in the way. So the maker of diesel motive power finds it advisable to train a nucleus of maintenance men for the roads it sells to.

Conventional part of the schooling is a diesel school at the LaGrange plant. Every two weeks 12 to 18 students, recruited from the maintenance forces of railroads, come to LaGrange for two weeks of intensive instruction. The school is not open to outsiders; students can come only from and must be sent by railroads wanting their men trained. It is working satisfactorily both to the manufacturer and also to the customers.

But to reach railroad shop men at scattered or distant points, Electro-Motive Corporation provides a traveling school. This is an old Pullman club car, rebuilt and refurnished for the purpose. What was the lounge section of the car now carries a stock of portable chairs, which are unfolded and set up when the car goes on a railroad siding for an instruction session. The other end of the car contains mounted exhibits, such items as a half-sectioned diesel cylinder and a hand-operated generator section. With these facilities people can be made competent to service the product.

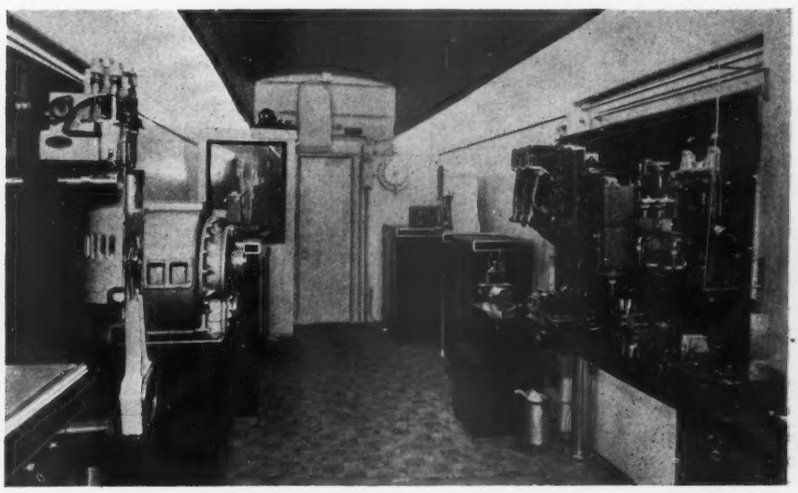
National Cash Register Company, Dayton, Ohio, recently improved several hundred acres of swampy land it owned, formed a park for the benefit of local residents.

Every Man Knows How to Pinch Hit

ROGER C. DICKEY, *Hudson, N. H.*

Because vacation time in summer and sickness in the winter generally raise havoc with production schedules, one manufacturer decided to train his entire staff to handle more than one job.

Of course there was some objection at first, but when the employees knew that other operators were being broken in on their machines, not with any intention of taking their jobs from them, but in order that they could run the machines in an emergency,



Equipment exhibits in Electro-Motive Corporation's school on wheels

and when they realized that the management was definitely going through with the idea, they acceded.

The different jobs or operations were classed in the order of their importance. Suppose, for instance, that four men work on a machine. The most important is the make-ready man, then the feeder, the delivery attendant, and the packer.

Suppose that the make-ready man is taken sick. The feeder immediately becomes the make-ready man at the prevailing rate of pay for that type of work, the delivery attendant becomes the feeder, and the packer becomes the delivery attendant. Several boys who are hired to keep the shop clean and do odd jobs have been broken in to pack whenever their services are required for this type of work, and one of these boys becomes the packer. Production is not affected in any way as the operators all along the line know what is required of them.

There is also another definite advantage in this practice. This firm starts at seven o'clock each morning. If the make-ready man is 15 min. late in the morning, it means that the crew on his machine is tied up for that length of time.

To eliminate this, the management called all the employees together and stated that if a man should be late all employees on his machine would step up one position for the day, and the late man would have the lowest rated position when he came in.

Now suppose the make-ready man on the machine mentioned above was late. The feeder would become the make-ready man for the day, the delivery attendant would become the feeder, and so on. The make-ready man would be the packer when he came in. In as much as the make-ready man gets $1.25 per hour, the feeder $0.90, the delivery attendant $0.60, and the packer $0.50, the regular make-ready man would lose $0.75 per hour for that day. Result of this arrangement was that no one was ever late.

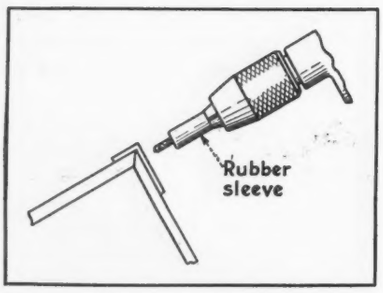
The firm gives each employee two weeks vacation, and because each operator knows different jobs and different operations, production does not suffer.

PRODUCTION METHODS AND MATERIALS

Rubber Sleeve on Drill Prevents Marring Finish

PETER L. BUDWITZ, *Meriden, Conn.*

In the final assembly of various products we make wide use of electric drills to provide holes for self-tapping screws. Since many of the parts are highly finished, the workmen had to exercise much care to prevent the drill from breaking through the sheet metal too suddenly. When that happened the drill chuck often struck the finished parts and marred them.



The danger of such mishaps was eliminated by slipping a rubber sleeve over the drill, as shown in the illustration. This precaution not only reduced the number of rejections, but it increased production because workmen were relieved of the fear of marring the work. They are now able to force the drill at a much faster pace since the piece of rubber will prevent any damage if the drill breaks through too suddenly.

•

Varnished Paper Drawings Stand Handling, Keep Clean

M. P. CORNELIUS, JR. *Moline, Ill.*

Engineering drawings for production work are often made directly on tracing paper in pencil only, instead of first being drawn on paper and then traced with India ink on cloth. In this way rush work can be put out in a hurry, with a saving in material and labor, but the product is short-lived because the pencil marks smear and fade with wear until no more blueprints can be made. Tracing cloth and paper also are subject to water damage and soiling.

To take advantage of the speed of direct penciling only, and at the same time increase the durability, pencil drawings on tracing paper are sprayed on both sides with one coat of the synthetic clear varnish which we use as a protective coating on some of our products. After drying for 24 hours, they are ready for use. The coating gives the paper a glossy appearance like that of tracing cloth, with the penciling protected beneath the gloss.

Drawings to be varnished can be finished by the draftsman in heavy black lines with a very soft pencil, for making superior blueprints.

For safety in welding: See that welders' clothing is relatively free from oil or grease and heavy enough to resist sparks igniting it.

Ball-bearing Pillow Blocks Rejuvenate Old Shaper

SOURCE
The Fafnir Bearing Company
New Britain, Conn.

A shaper with babbitted bearings had been discarded after many years of use by a Grand Rapids plant because after repeated rebabbitting of the bearings, the productive capacity declined.

Because he was not convinced that the machine was worthless, the plant superintendent had two heavy-duty, ball-bearing pillow blocks installed in place of the worn babbitted bearings, and put the shaper back in production. It's reported to be working better than ever.

•

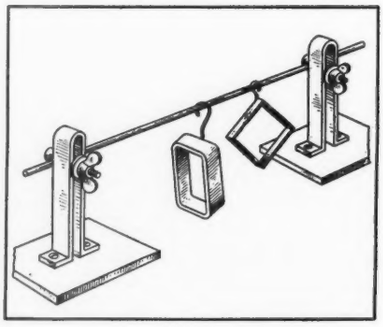
Adjustable Spray Rack Handles Variety of Work

CHAS. H. WILLEY, *Penacook, N. H.*

A spray rack that is adjustable for height and easy to make is shown.

Two pieces of ¼x1¼-in. bar stock are bent to serve as uprights. A couple of drilled studs with wingnuts. and a length of ⅜-in. diameter rod complete the assembly.

The supporting rod can be adjusted to any height or angle desired. A pair of such racks will accommodate a wide variety of spraying jobs.



Going "Straight-Line"?

Then heed this good advice out of the clothing industry. It'll work for you, too

HUGH L. THOMPSON
Production Engineer
Patterson Manufacturing Company
Denison, Tex.

IN THESE DAYS of windfall tax collectors nosing through three-year-old records, ventriloquist dummies on every unoccupied knee, and streamlined garments for the working man, it behooves us to consider that old misnomer that has recently made its way into the garment industry—straight-line production.

The basic principle of straight-line production is to make work flow along the line of least resistance, and that line is seldom straight. In the garment industry it never is. Work does not flow, but starts and stops, and starts and stops, like a milkman on his route. But it gets there.

Some concerns still adhere to the old "bundle" system which might better be called the "back-breaker" or "high-inventory" system. Who wants a high inventory of work-in-process nowadays? A high inventory is to a factory what high blood pressure is to a man. It may pep him up at times, but sooner or later it gets him down.

If we want to change over to a "straight-line" system, where should we start? Should we hire a stopwatch, with a man and a slide rule to go along with it, in order to delve into the deep mysteries of "B's," "Manit's," and whether Sadie is a fast operator or just has the reputation of being fast? No, we should first look to our merchandise lines. Where would Henry Ford be today if he had 137 different lot numbers and a production of 100 cars per day? Sales lines must be streamlined to fit straight production lines. Several different kinds of material may make no difference to a "straight line," but an extra buttonhole might.

Now are we ready for the genius to start operations whose stock in trade is wage-payment plans, mean averages, and split seconds? No, not yet. Human habits cannot be forced into a change overnight without friction. Habits are as hard to change as that animal of sterling qualities, the Missouri mule. Therefore, everyone about the place should be exposed to the advantages of modern methods and made to desire the change.

It's Good Business

At this time, good light, air, heat, restrooms, rest periods, and those other items that go hand and hand with good business principles should be given proper consideration. You do not get inspired music from a chilled musician or volume production from a cold operator.

Now we are ready to get down to the details of time and motion study and the set-up of the line. A clever man with a stopwatch can eliminate many useless motions, properly divide operations, and set time standards. Do you realize that most sewing machines actually sew less than two hours in an 8-hour day? That means there is plenty of room for improvement.

Operators should always know when they are being studied. Anyone who would sneak a time study on an operator would steal from his best friend. Besides, the trained man with the watch has all the advantage. Not one operator out of 500 can fool him with an attempted change of pace. A stopwatch shows up a series of motions like a microscope shows us the secrets of infinitesimal objects.

There are many kinds of production lines, using chutes, tunnels, tables, etc., but the best line is the one that eliminates the most operator handling time. That's common sense, as handling time is waste time.

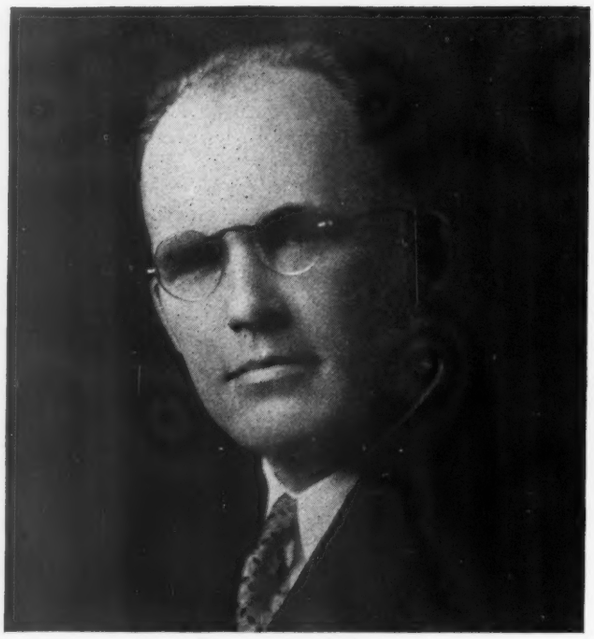
Now we come to the most important item in the whole set-up—balance. With balance the line succeeds. Without balance the line fails. Balance is to the line what teamwork is to the football team. Each individual must

(*Continued on page 104*)

This is artist J. Groth's idea of straight-line production in a garment factory — a bit sketchy, on the whole, but at least he realized what a whale of a difference an extra buttonhole may make

AUDIT YOUR PAY PLAN NOW

A world of good intentions won't make a wage plan fair and stimulating if all the factors haven't been considered. Check your plan against these points



H. E. BOYD
Industrial Engineer
The Berger Brothers Company
New Haven

Back in 1916 Mr. Boyd made his industrial bow as timestudy man for The Republic Metalware Company in Buffalo. He remained 12 years, becoming an industrial engineer and assistant to the general manager. From there he moved to Nashua Gummed and Coated Paper Company for a couple of years to tackle incentives and waste elimination. Spent another year working in bakeries, oil refineries, wood-working, steel, and candy-making plants as a staff engineer with Stevenson, Jordan & Harrison. Eight years ago he came to his present berth where he has developed incentives in factory and office, devised better methods and equipment, worked on waste elimination and quality control.

A FOREMAN SAID to his superior, "I think I deserve a raise." Here is what followed. The requirements of every job in this plant and the aptitudes of every employee had been measured. Salary rates for this foreman's job and his own place in the scale were based on this rating. The superintendent went over the rating plan with the foreman and asked him to study conscientiously the points on which his job and he himself had been rated, and on which his salary had been fixed. The foreman returned. He said he had gone over the plan again. He said he had rated his job and himself on each point, and he said that he had come to the conclusion that his salary was fair for the job he was doing and consistent with the salaries of other foremen.

Job Determines Rate

If one of your foremen comes to you today with the same complaint, can you satisfy him with your fairness as effectively, convincingly, and completely as this foreman satisfied himself?

Whether your method of payment is bonus or piece rate, the base rate must be the starting point for fair payment. The wish to make base rates right by no means assures getting them right. Executives and labor committees have wrestled with this matter for days and weeks, and out of such efforts have come rates that seemed, to those who determined them, exactly what such rates should be. An impartial observer, however, would recognize many such rates to be the result of a conglomeration of whims, prejudices, and compromises.

The base rate must be consistent both with the rate that is paid by other employers in the community for similar work, and with rates paid for similar and dissimilar jobs in the same plant. Proper base pay for a given job depends upon all the characteristics of aptitude, skill, and experience that are needed to do the job right. Pay should attach to the job and not to the individual.

Scientific job evaluation is required before the time rate of pay can be determined. All jobs must be appraised, and the factors that should determine rates defined and weighted. A few of these factors are judgment, monotony, accuracy, responsibility for the safety of others, eye strain, danger, and strenuousness. All jobs that merit the same rating should get the same pay. Each job should be assigned a starting rate, several intermediate rates, and a maximum rate.

Standard time is the basis for every incentive plan that has any claim to being scientific. Production is measured by determining the standard time for the job, and then figuring the ratio of standard time to the actual time taken to do the work. If the standard time is wrong, some employee will receive less pay than some other employee who is no more efficient.

Yet as late as 1935, 339 out of 528 companies, or 64.2 per cent, which used standard times, set them not from time studies but from averages of past experience, or based them on results of "careful analysis of past records." This fact was disclosed by an analysis made by the National Industrial Conference Board. Practically all these standard times, it is safe to say, were unfit to measure production.

Past experience is not a correct measure of what future experience will be. Design of product is constantly changing. Some changes lengthen and some shorten the time for doing work. Employees vary in effectiveness. A well-managed plant with a high average labor effectiveness will always have some individuals who are working at 80 per cent effectiveness or even lower, and at the same time other employees habitually will turn out 110 or 120 per cent of standard production. Equipment and methods are constantly changing in ways that increase time and in ways that shorten time. If a standard time is set from past experience, its accurate measurement of tomorrow's production is dependent almost upon blind chance.

Who sets your standard time? The same 1935 Conference Board analysis revealed that 68 of 388 companies, 17.5 per cent had timestudies made by foremen or plant executives who were not timestudy specialists. Such practice means only confusion and inequality.

Foreman Must Respect Times

Timestudy is a science and an art, a science because it is based upon a definite technique, an art because the skill and effectiveness of the workman must be evaluated. It is a job for the specialist. The timestudy man sets standard times by stopwatch, and makes all standards consistent, one with another. The foreman, even if he uses a stopwatch, cannot be as experienced or as skillful as the specialist because timestudy must be a side line with the foreman.

The foreman must have confidence in standard times set by the timestudy department. To have that confidence the foreman should be familiar with the methods of that department, be convinced of the department's ability, honesty, and impartiality.

Rate changes should be made as quickly as proper standard times can be determined for new work, and for changes brought by new machines and methods. But be sure that the studies are made just as soon as possible. If reduction of a rate is necessary, the employee can't help thinking that a tardy reduction is caused by too high earnings and not by the operation change. It is hard enough to convince the employee of the fairness of a new rate, if a reduction, even when quickly made.

On the other hand, a man who continues to work on a rate after an operation has been changed, so that it requires more time, is underpaid.

Whatever the change, the employee should first have enough experience on the new operation to become fairly competent, certainly better than 75 per cent effective. Then a new timestudy should be taken and a new standard time should be put into effect.

Seldom appreciated is the frequency of the need for change of standard times. One company that used about 1,500 standard times had to revise 48 per cent of them in 1933, 35 per cent in 1934, 69 per cent in 1935, and 44 per cent in 1936. In other words, in 1935 the average life of a standard time was less than one and one-half years. Unless we are willing to maintain our standard times correct and up to date, it is unwise to attempt to use them at all.

If the old rate is not to be continued after a change, how should the employee be paid for the time that elapses between the change of operation and the placing of a new rate? The employee's hourly rate alone is insufficient because it is lower than his incentive earnings. Probably the fairest method is to pay the average incentive earnings for about four weeks before the change.

Standard times have been reduced in some instances because employees were thought to be earning too much money. Whether high earnings are properly earned by very efficient workers on correct standard times, or are improperly earned by average workers on incorrectly set times, if rates are reduced, employees soon learn that it is not safe to make too much money, and freeze production at a "safe" amount. This is expensive for the employer because further reductions of unit cost will be impossible.

Belief is widespread among employers and employees that high earnings make high costs and low earnings make low costs. This is a fallacy. The employee wants high hourly earnings; he wants to take home as much money as possible. The employer wants low unit costs. But the two ideals are complementary, not antagonistic. When the method of pay is correct, higher earnings make lower costs.

On a certain bonus job the standard time was one hour for 100 pieces, and the base rate was 50 cents an hour. Table I shows what happened to hourly earnings and unit costs when 100 pieces were done at different effectiveness.

The last two columns tell the story. Except for changes of conditions and methods which make the work easier, standard times should never be cut.

Shortages Spoiled Incentives

Employees may suffer from idle time in two ways: First, they may be idle and receive no pay; second, they may receive hourly rates for the idle time but lose income because these rates are less than their accustomed piece rate or hourly bonus earnings. Is it unreasonable for employees to expect to be paid for idle time that is no fault of their own?

One plant with incentive workers suffered from shortages of material, caused by poor stockroom records and inefficient purchasing. There were other shortages in semi-finished product. Poor planning did not anticipate requirements. When these conditions were remedied, practically all material shortages were eliminated, earnings were increased, and unit cost was cut.

In another plant, machine breakdowns were causes of idle time. This company rejuvenated its maintenance department by preparing a set of instructions for mechanics, which required periodical machine and tool inspections and periodical adjustments of belts and checking of machine speeds. Breakdowns dropped to 20 per cent of what they had been before management learned to anticipate breakdowns by applying the old the-

(Continued on page 128)

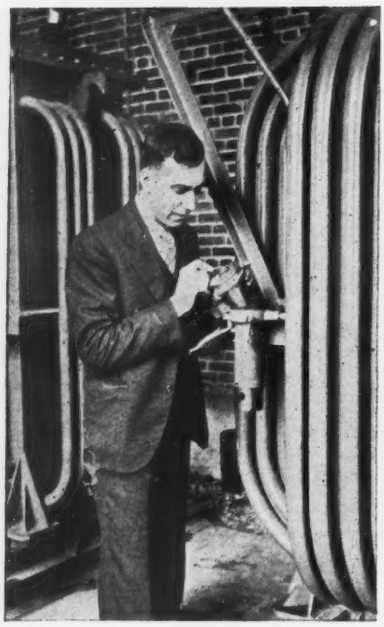
TABLE I. How Hourly Earnings and Unit Costs Vary

Effectiveness %	*Actual Hours*	*Wages Per 100 Pieces at 50c. Per Hr.*	*Bonus*	*Cost Per 100 Pieces*	*Cost Per Piece*	*Earnings Per Hr.*
50.....	2.00	$1.00	.....	$1.00	$0.01	$0.50
66⅔.....	1.50	.75	.....	.75	.0075	.50
80.....	1.25	.625	$0.01875	.64375	.0064	.515
90.....	1.11	.555	.0555	.6105	.0061	.55
100.....	1.00	.50	.10	.60	.0060	.60
110.....	0.91	.455	.1365	.5915	.0059	.65
125.....	0.80	.40	.18	.58	.0058	.725

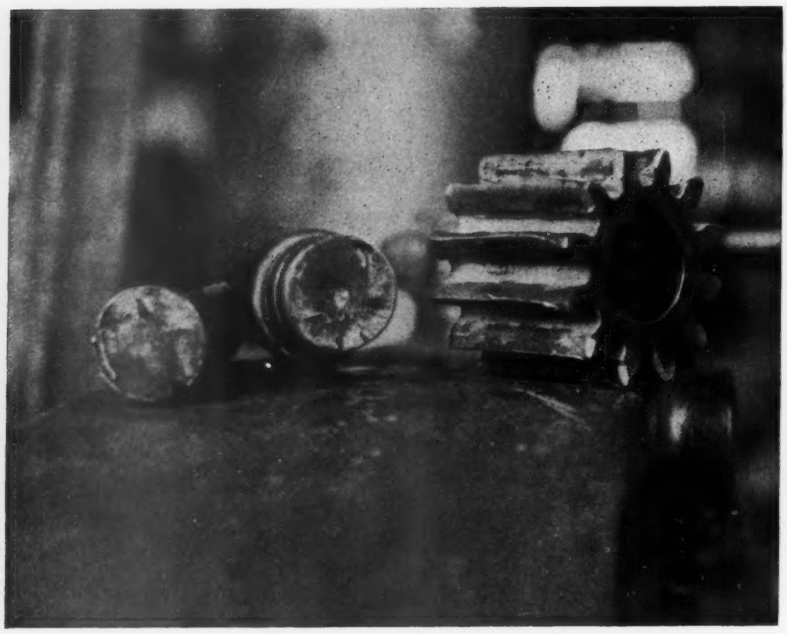
MOTOR TROUBLE?
It May Be Your Drives

Improperly aligned couplings, belts too tight or too loose, worn gearing, and other defects in mechanical power drives often cause troubles that are unjustly blamed on the motor

LIONEL A. HUNT
Engineer, Bepco Canada Limited, Montreal



Lionel A. Hunt, caught here in the act of checking up on something, walked 2½ miles to school as a boy, with the mercury sometimes 40 below. Born in England in 1904, he came to Canada at the tender age of four. Served his apprenticeship, took I.C.S. courses, became a Professional Engineer of British Columbia in 1932. When the Vancouver firm he was working for went bankrupt, he took three trips to the Orient as an electrician on the Empress of Japan and Empress of Canada. Later worked his way East, arriving in Toronto with $5 and a railway pass back to Vancouver; landed a job winding motors. Started with Bepco in 1934, soliciting repair work; took over management of Toronto shop in 1935; transferred to Montreal in 1937; now in charge of outside service and installations.



Inspection would have disclosed the bad condition of this pinion and prevented breakage of the shaft

EVERY PRECAUTION taken in the selection of the correct motor for a particular application, and the attention afterwards given it in service, will be of little effect in insuring trouble-free operation if the drive connection is not right. Too frequently shutdowns occur from broken shafts, cracked rotor bars, defective bearings, or split fans, because the mechanic who installed the equipment failed to make sure that the drive was put in properly. No matter what type of drive is used —gear, V-belt, flat belt, rigid coupling, flexible coupling, or chain—it can be correctly or incorrectly installed.

In some well-managed plants it is the practice to have each new or altered drive inspected after installation by other persons—often the drive manufacturer's engineers.

Through no fault of its own, one of the most troublesome drives is the flexible, direct-coupled type, more frequently used on motor-generator sets, fans, or pumps. In about three instances out of four the mechanic does not put himself out to line the job up as he would a rigid coupling, "because it is flexible." The machines are therefore tightened down and doweled slightly out of line. Constant effort of the flexible coupling to bring itself into line results in worn coupling buffers. If these buffers are made of rubber, a powdery dust sometimes gathers under the coupling. The effort to secure alignment also tends to spring the shafts into line, and in addition to shortening bearing life

(the bearings farthest from the coupling often go first), frequently results in bad commutation of the m.-g. sets.

Serious attention should be given to the drive of any installation where a nickel cannot be balanced on the motor for at least 10 seconds. A rapid knocking sound, sometimes quite muffled, is a good indication of misalignment. If convenient, and the set is not too large, slack off the holding-down bolts of the motor or driven machine while the set is running and bump the feet with a block of wood to change slightly the position of the loosened machine. Care must be used not to loosen too much, or to bump too hard. If the knocking changes its tone, keep

The motor gets a new shaft and the repair shop another job, all because an installer saved time by not aligning this rigid coupling

experimenting until the knocking disappears entirely. It may be necessary to shim up one of the machines a few thousandths before success is achieved.

It is imperative that rigid-coupled jobs be very carefully lined up, and flexibly coupled jobs should receive much the same attention. Place a straight-edge across the coupling flanges (peripheries) and hold a light behind the straight-edge. No light whatever should be seen along any section of the straight-edge at top, bottom, or on either side.

If the coupling is of a type with which it is impossible to use a straightedge, some similar test must be applied. When light is seen at the top, rest the straightedge on the higher coupling so that snug contact is made across the entire flange and raise the lower machine up with metal shims to the required height.

If light is seen at either side, move one machine over to correct the position. These tests should be made once without disturbing the coupling and should be repeated with first one coupling rotated 180 deg. and then the other. This procedure will show whether one shaft is sprung or one of the coupling halves has not been bored concentrically, which is a serious error. Before marking the coupling halves to insure that they will always be put together the same way, double check by pushing the halves apart and inserting a feeler at the four locations mentioned above. Again rotate first one and then the other coupling 180 deg. and recheck. The same size of feeler should, of course, be a nice "feeling" fit at these four locations.

If the coupling halves cannot be separated enough to insert a feeler, there is grave danger that bearing failure may result from excessive end-thrust, due to shaft expansion when the set has reached its operating temperature. This danger is particularly marked with ball bearings. Care must always be taken to make sure that a ball-bearing motor with a location bearing giving no end-thrust is not direct-connected to a generator or pump that is similarly arranged. When such a situation arises one location bearing or the other must be given some lateral movement.

When a hot water pump is direct-connected, final alignment should be made when the set is at its operating temperature, because expansion of the pump may lift the centerline of the pump shaft.

A straight spur-gear drive is another type that gives trouble. It is well to avoid use of such a drive if at all possible, because vibration can seldom be entirely eliminated and trouble may show up somewhere. Where a spur-gear drive must be used, make sure that the motor is rigidly mounted with respect to the driven machine. If each is separately mounted without tie rods between, the loading and shape of the teeth tend to force the machines apart, and rapid oscillation of one or the other may result. This action often results in broken rotor bars, bearing failure, or cracking of some part of the motor or machine.

These troubles have also been encountered where a cast ring gear was used which under load became distorted and meshed unevenly Teeth of the gears must not "bottom." One entire revolution of the ring gear should be made, tooth by tooth, to insure a slight clearance between the teeth as they mesh, to prevent the gears from being sprung apart.

Double Check Chain Drives

In a plant where lint or troublesome dust, chips, filings, or the like are present, the gears should be periodically freed of accumulations at the roots. Rawhide or phenol composition pinions should be used to minimize noise, but must not be relied on as a corrective measure for defects in gears, alignment, or rigidity.

Trouble is to be expected if worn pinions are replaced without also replacing the worn gear.

Chain drives present peculiar problems of their own. With these drives the greatest attention must be given to having the shafts absolutely parallel and level, and the sprockets exactly in line. A taut piano wire stretched to pass by the sprockets near their centers, and close enough to the sprocket faces to insert a feeler at the two points on the periphery diametrically opposite, will also serve as a line for applying a square to check the parallelism of the shaft. Sprockets must be tight on the shaft, so that lateral creepage is impossible.

The chain should not be too tight and must be adequate for the load, since stretching results in the chain having a different pitch from the gears, and excessive wear follows. If

(Continued on page 106)

EDITORIALS

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Two Viewpoints on Maintenance

OPERATING CONDITIONS in a certain plant were not particularly severe, but an unusual amount of trouble was experienced with the equipment. Upwards of a dozen men in the maintenance department were kept wildly busy, rushing hither and there, patching up one thing or another. Virtually every job was an emergency. All manner of expedients frequently had to be employed to get production going again.

Then a new chief came in, who firmly believed that a little preventive maintenance is worth a great deal of frenzied repair work after some item of equipment has failed. Careful inspection and maintenance of all equipment at frequent intervals was established as a routine that had to be followed without deviation.

In a surprisingly short time, emergencies became fewer, shutdowns less frequent. Before long, the maintenance force did not have enough work to keep it busy. That situation was eventually remedied by transferring more than half the men to other departments. Now less than half the former crew finds no difficulty in keeping every machine running. A real breakdown is an exciting event.

Skillful planning doubtless played some part in bringing about these changes, but chief credit must go to a radically different conception of the primary function of maintenance.

Formerly the maintenance department was concerned solely with making repairs after failure had occurred. Now, it bends all efforts to detecting and remedying conditions that result in breakdowns. Just a difference in viewpoint—but an extremely important difference.

Consider the Better Materials

RESEARCH in the development of new materials during the past few years has done much to deflate the once proud boast that skillful repairs have made a piece of equipment "just as good as it ever was." From the standpoint of accuracy of workmanship such a claim may well be a matter of pride. But there are many instances where "as good as it ever was" is not good enough. Someone has failed to study the requirements and take full advantage of the new products that have been brought out to meet some of industry's problems.

Ferrous and other alloys have been made available that are much superior in strength, resistance to corrosion, or some other quality to anything commercially known a comparatively few years ago. There are new protective coatings of various kinds, including paints, whose durability under severe conditions is away beyond anything known before. One can easily obtain wire with glass insulation that is unaffected by temperatures up to a low red heat—and a host of other aids to low maintenance costs.

These new materials are rapidly finding their way into present-day equipment. They will serve equally well in replacing vulnerable or troublesome parts in machines that were built in the days when designers had to make the best use they could of the materials and metals then available.

Before any broken or defective part is replaced it is a good idea to find out whether some other material would give better service than the original.

Industry's New Tool: the Fluorescent Lamp

RECENT INTRODUCTION of the fluorescent lamp has given industry a greatly improved tool, whose possibilities are still largely unexplored. Practical experience as well as research have indicated, however, that these new lamps make it possible to achieve results that were heretofore unattainable.

One of their most important features is the ability to produce directly a close approximation to daylight, at high efficiency. With previous light sources the best that could be done was to pass the light from a glowing tungsten filament through filters. These cut off so much of the light that the available portion was produced at an efficiency of a few lumens per watt. With the fluorescent lamp, illumination that is sufficiently close to daylight quality to be satisfactory for most commercial color work is produced at an efficiency of 30 lumens per watt.

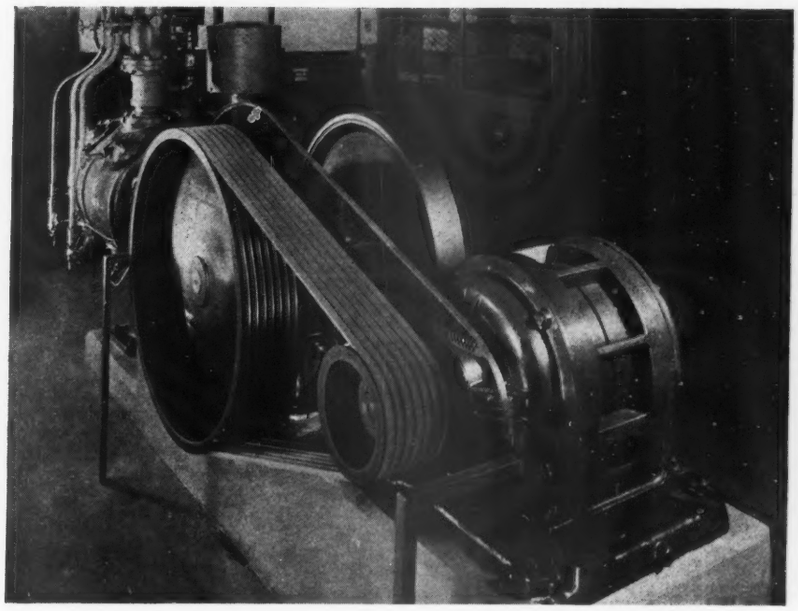
The reason for this high efficiency is, of course, that the lamp operates on a principle much different from that utilized in hot-filament lamps. Certain fluorescent materials inside the lamp tube are excited and glow under the ultraviolet energy produced by a discharge through mercury vapor.

Light of various other colors can be produced just as easily and at the same or higher efficiency than in the case of daylight-quality illumination.

It is hardly to be expected that these new lamps will find wide use for general industrial lighting, at least for some time, but it is certain that they are the answer to many lighting problems in connection with color matching and inspection work.

Six Checks on V-Belt Drives

1. **Choose belt for the actual load conditions**
2. **Use short center distances**
3. **Use sufficiently large sheaves**
4. **Design drives for standard stock sheaves and belts**
5. **Provide ample take-up and slack-off**
6. **Consider matched sets**



Adequate provision for take-up, pulley sizes in proper relationship and comparatively short center distance help to make this a well-designed V-belt drive

R. T. KAIN

Belting Division

The B. F. Goodrich Company, Akron

DURING THE past few years V-belts have been applied to many miscellaneous power drives. When making such applications it is only natural that some of the fundamental conditions which are necessary for satisfactory V-belt life have been overlooked, or perhaps disregarded. Most of these conditions are well understood by many plant men, but there are a few that cannot be emphasized too strongly. The following merit particular attention:

1. *Choose Belt for the Actual Load Conditions.* Some of the most acute troubles that have been encountered in the field can be traced directly to under-belting. Often, when a change-over is made, the actual load imposed by the drive is not known. Often, too, the prime mover was not purchased or chosen specifically for that drive and may be of a type or rating too powerful for the number of belts applied. Basically, all drives should be belted to take care of the highest peak load that is ever developed.

Unfortunately, these actual conditions can be determined only by the use of a recording wattmeter connected in the motor circuit, over a period of time that is known to cover every actual operating phase of the machine. Often, however, the point of operation at which the load is heaviest has been definitely ascertained from months or even years of observing the machine, and time can be saved by simply measuring the load at that point.

If it is impracticable to measure the load and definitely find out the conditions with which you have to deal, then at least give due weight to the overload factors listed in the sheave and belt manufacturers' data books.

2. *Use Short Center Distances.* The V-belt drive is essentially a short-center drive. Approximately two-thirds of the power-transmitting qualities of a V-belt come from the gripping action of the belt against the walls of the sheave groove. It is therefore unnecessary to give the same consideration to arcs of contact as when using flat belts. Generally speaking, a center distance equal to or greater than the diameter of the large sheave, and not more than the sum of the diameters of the two sheaves, will give good, practical results.

Standard engineering data books covering V-belt drives show, in the drive tables, the limits of the center distances recommended.

When too long a belt and, consequently, too long a center distance is used, any tendency to whip or vibrate can be accentuated to the point where belt life is materially reduced. Also, when long center distances are used, full advantage is not being taken of the saving in space that can be accomplished by the use of V-belt drives.

3. *Use Sufficiently Large Sheaves.* Minimum pitch diameters for use with various standard belt cross-sections have been determined from years of laboratory and field experience. The use of sheaves of smaller diameter can only reduce belt life. When extremely small sheaves are used, the life can be reduced by very startling percentages. The use of sheaves that are materially below the recommended diameters is very common practice in laboratory testing, for reducing belt life. The choice of too small a sheave, therefore, may place

Table I. Minimum Recommended Pitch Diameter of V-Belt Sheaves

Belt Section	*Approximate Belt Size, In. (Top Width and Thickness)*	*Minimum Recommended Pitch Diameter, In.*
A	½ x 11/32	3.0
B	21/32 x 7/16	5.4
C	⅞ x 7/32	9.0
D	¼ x ¾	13.0
E	1½ x 1	21.6

your drive in the classification of a laboratory breakdown test from which, of course, good belt life can never be expected.

These minimum diameters have been so definitely determined that they are, generally speaking, standard recommendations of all manufacturers. They are listed in Table I.

The fact also must be recognized that the use of sheaves of less than the recommended minimum diameter can materially reduce the horsepower capacity of the belt, and thus lead to troublesome situations.

4. *Design Drives for Standard Stock Sheaves and Belts.* Standard and stock items of both sheaves and belts are well defined in the various engineering data books. The size range is such that non-standard items are rarely necessary, after due regard has been given to permissible variations from the theoretically desired speed ratio.

If, therefore, every effort is made to utilize these stock items, the original delivery of the drive can be made quickly, and no difficulty will be encountered in picking up replacement belts or sheaves if that becomes necessary in due course of time. Often, too, sheaves of pressed steel, or the light-duty, cast-iron type, can be used in the A and B sections at a material saving.

There is a definite relation between sheave design and belt life. Standard sheaves as made by all reputable manufacturers have the correct groove angle and design to operate with the standard V-belt which has an angle of approximately 40 degrees. It is poor economy to use a sheave without being sure of the angle, since a sheave of non-standard construction, which may happen to be on hand in the storeroom and seem to suit the purposes of the drive, may be made to an angle that will cause severe and rapid side wear on the belt.

5. *Provide Ample "Take-Up" and "Slack-Off."* There are very few occasions when it is necessary to design a unit drive with fixed centers. This practice should be avoided. Any V-belt will elongate after use. Therefore, if the belt is applied with the correct operating tension, this tension will lessen with elongation, and unless there is adequate means of take-up, slippage, loss of power, and greatly reduced belt life will be the result.

Failure to provide slack-off causes a serious condition in applying belts to the drive. When there is sufficient slack-off, the prime mover can be moved toward the driven end of the machine and belts slipped easily over the sheave and into the grooves. If it is not provided, the problem of getting belts into the grooves is often solved by the use of some type of bar which is used as a "persuader." It is possible to damage seriously, or even break the belt, by the use of such a tool.

6. *Consider Matched Sets.* Much has been said in recent years of the desirability of furnishing belts all of the same length. Naturally, it is extremely desirable to have each individual belt on the drive take its share

(*Continued on page 104*)

INSULATION RESISTANCE From Hot to Cold

THERE IS general recognition of the fact that **temperature affects** the insulation resistance of all electrical machinery. The exact quantitative effect is, however, not so widely known. From a large number of tests on many different types of machinery the following formula has been derived which expresses this relation mathematically:

$R = rC^n$, where:

R = Insulation resistance at the higher temperature (T degrees Centigrade)

r = Insulation resistance at the lower temperature (t degrees Centigrade)

C = Constant
For class A insulation = 0.44
For class B insulation = 0.63

n = Exponent (T degrees $-$ t degrees) $\div$ 10

T = Higher temperature, degrees C

t = Lower temperature, degrees C

The nature of this phenomenon is such that when insulation resistance is plotted against temperature or temperature difference on semi-log paper the curve becomes a straight line. Since it is often desirable to translate insulation resistance from one temperature to another without calculation or the use of special curve paper a simple graphic method has been worked out. See page 77.

It comprises the use of a graph for determining the effect of temperature on insulation resistance for both class A and class B insulation. No equipment except a straightedge is required. It is only necessary to place the straightedge from the Known Insulation Resistance scale at the right through the value of the Temperature Differential on the center scale; it will then intersect the Unknown Insulation Resistance scale at the left at the correct value.

Example: Assume that a machine with class B insulation has 600,000 ohms insulation resistance at 120 deg. C. What will be the value of the insulation resistance at 30 deg. C.?

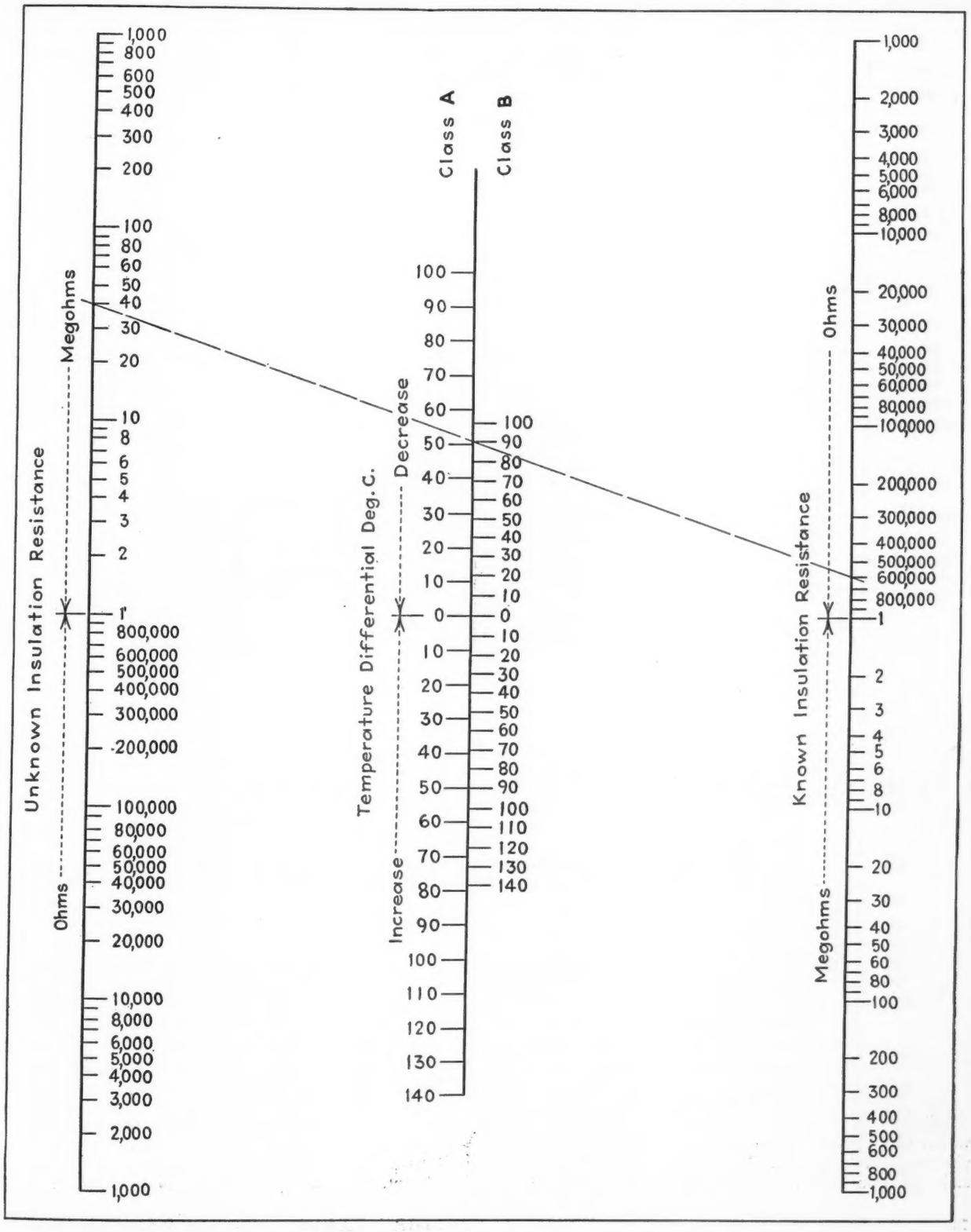
Here's How

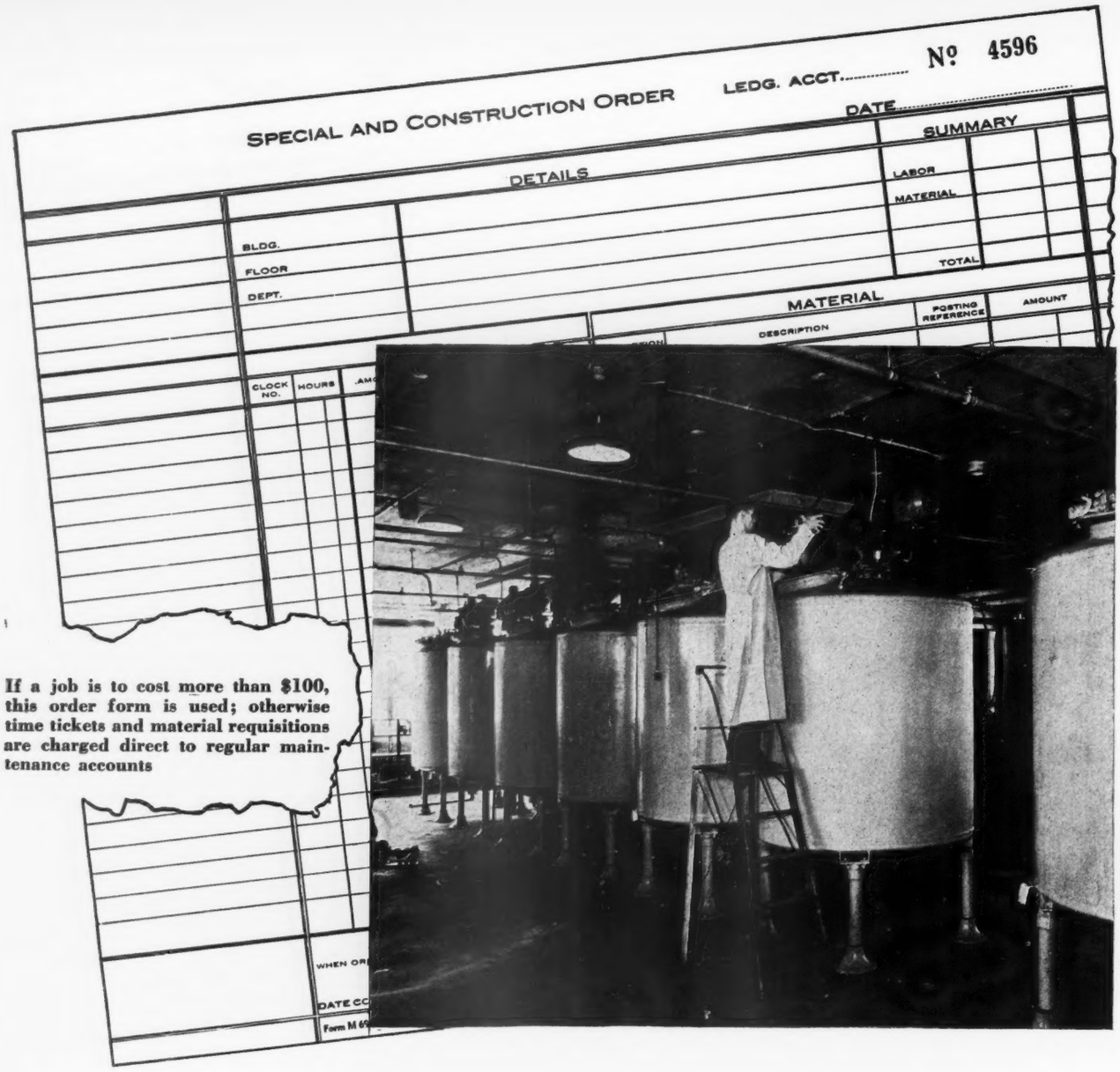
In this instance the temperature differential is 90 deg. C. Place a straightedge so that it intersects the right-hand scale at 600,000 ohms and the *right-hand* side of the center scale at 90. It will then intersect the left-hand scale at 40 megohms, which is the insulation resistance of the machine at 30 deg. Centigrade.

For machines with class A insulation the straightedge is placed as before except that it must intersect the line representing temperature differential on the *left-hand* side of the center scale.

G. L. MOSES, *Transportation Insulation Engineer, and* E. I. STAPLES, *Laboratory Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

How Insulation Resistance Varies with Temperature





If a job is to cost more than $100, this order form is used; otherwise time tickets and material requisitions are charged direct to regular maintenance accounts

One Report a Month Keeps Maintenance Costs in Line

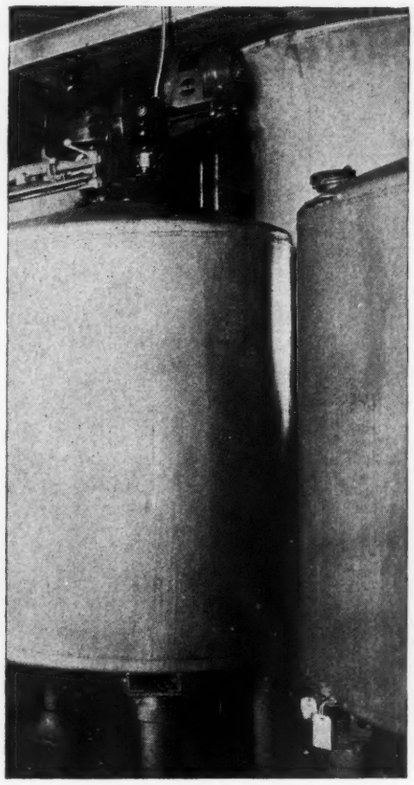
ALL THE MEDICINES a pharmaceutical plant produces are of little avail in curing one of its most painful headaches—the problem of holding expense to a minimum while keeping equipment and buildings in good working order.

Some 300,000 sq. ft. of floor space is utilized here in producing a wide variety of drugs, medicines, and other pharmaceutical products. Since we make our own power, operation and maintenance of the power plant comes under the mechanical superintendent's jurisdiction. Other functions in the department are similar to those in other manufacturing plants; for example, we have a mechanical department, an electrical department, and a carpenter and paint department.

While the fluctuation in sales is doubtless less than that in many more seasonal industries, yet, except for the operation of the power plant, we have not found it advisable to budget our maintenance. Instead, a simple monthly report is utilized in keeping this expense running on a fairly even keel the year round.

When required, the mechanical superintendent prepares plans and specifications for certain repairs and alterations, estimates the cost, and suggests items for consideration that will increase the value of the equipment or building to be repaired. If

Plenty of jobs for the maintenance department around these big mixing tanks—motors, speed reducers, and agitator drives to lubricate; stuffing boxes and valves to keep tight, exterior and interior surfaces to clean; floors to repair; and always a job of painting in sight



L. A. PIERSON

Chief Engineer
Frederick Stearns & Company
Detroit

such an item is decided on, its cost is not a part of expense, of course.

After approval of these plans, a construction order number is designated, and all labor and materials in connection with the job are charged to it. Actual cost is checked with the original estimate, and investigated when in excess. When the alteration or repair has been completed, the accounting department breaks the cost down, and, in conjunction with the engineering department, determines what items may appropriately be capitalized and what items should be charged to expense.

Three copies of the construction order are provided, one going to the foreman who is to do the work, one to the time and cost department, and one to the accounting department. Time tickets and material requisitions are numbered to correspond with the construction order number.

At the time the cost estimate is made it is decided whether a construction order is necessary. If the estimate is less than $100, no order is made out. On jobs costing less than this sum, all time tickets and material requisitions are charged to regular maintenance accounts. The maintenance department has been instructed as to the numbers assigned to these accounts in the books so that it can properly charge time and material.

Two Sources of Expense

The monthly report of book accounts shows maintenance expense accumulated from two sources—internal charges, which cover the portions of construction orders deemed to belong properly to expense, and external charges arising from outside repair service and supplies charged direct.

In some plants expense is budgeted on the basis of productive labor hours. We have not found it advisable to follow this practice. The relation between productive labor hours and maintenance we find is rather indefinite, for, when production is lowest, equipment and building are most available for our work. Consequently, a ratio of expense to production would convey no meaning for control purposes. For example, it is the policy to close the plant for two weeks in July. In June an estimate of the work to be done during these two weeks is made and submitted to management for approval. Expense in this case varies inversely as production.

L. A. Pierson came to Frederick Stearns & Company in 1926 as Chief Power Engineer. Promoted to Maintenance Engineer in 1928, to his present job in 1935. A registered (Michigan #2861) M.E., he is a past president of the National Association of Power Engineers. Educated, I.C.S. and Columbia University. World War veteran, he served as an ensign in the Navy.

The use of sales as a basis for a budget would not be practical because all our orders are filled from warehouse stock.

However, maintenance expense must be controlled, and certainly in some relationship to plant activity. From the accounting summary mentioned above a monthly report is furnished stating the expenses for the month just closed, for the same month the previous year, and for the succeeding month of the previous year.

Preceding Year a Guide

This affords a historical comparison. If the past month indicates considerably heavier expenses than were incurred in the month the preceding year, projects are looked at carefully with the thought in mind of bringing them back into line in the succeeding month. This becomes a feasible policy due to our anticipation of maintenance work for the July shutdown. If operations are running below those of the previous year, we hold our maintenance expense below the total for the last year.

Power has been mentioned as an exception to other expense items. Power, light, heat, and process steam are closely related to the productive load on the plant. We have found it practical to budget these costs as a definite percentage of sales. A monthly report, similar to the one mentioned above, indicates whether or not we are successful in keeping within the allowance.

No little credit for the low level of these costs is due to the cooperation secured from the maintenance department employees. With an average length of service of 7½ years, steady employment, and all firing in the hands of the works manager, a feeling of security induces a willingness to cooperate.

For example, millwrights may be called on to change the location of a machine. While making the change, it may appear to them that repairs are advisable, and that they may have to tear it down a few months later. They suggest, therefore, that it be sent to the mechanical department. Here the repair men consider, let us say, that repairs would be rather costly, and take the matter up with the mechanical superintendent. This then forms the basis for an investigation as to the advisability of replacing the old with new equipment. This is typical of our daily practice and accounts in no small way for low maintenance costs.

Figure 1. There is no guesswork about it when a meter is given the job of finding out whether a motor is properly loaded

LIKE TO CUT POWER BILLS?

Limiting demand, raising power factor, and preventing waste are important measures, but to apply them most effectively requires study of the power contract and the characteristics of the load

JOHN F. MOORE

Electrical Engineer, Dunlop Tire & Rubber Goods Company
Toronto, Canada

MANY PLANTS could reduce the bills paid for purchased electrical power if the matter were studied in a systematic way. Probably the chief reason why more plants to not investigate this important item of costs is ignorance regarding the nature of the electrical load, how it is measured, and the basis on which the charges are figured. As the natural result of this lack of understanding, power bills come to be regarded as an unavoidable and irreducible expense which is paid each month with little if any consideraion.

Before you can do anything about cutting the cost of purchased power it is first necessary to determine exactly what you are paying for. Find out what billing meters are used by the power company and exactly how they work. The quantities usually measured are:

1. *Energy,* which is invariably measured by the familiar integrating watt-hour meter.

2. *Kilowatt demand,* which is a measure of the maximum power taken at any one time. The exact meaning of the term depends upon the manner in which this quantity is measured, which may be by:

(a) Graphic wattmeter, the demand being the maximum load which is sustained for a specified length of time.

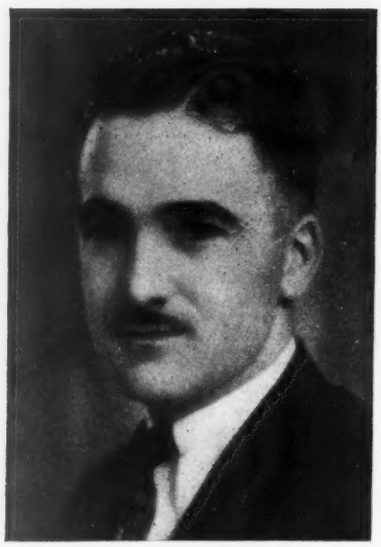
(b) Block interval meter which records the maximum energy used during any one period of definite length.

(c) Thermal demand meter, which records the maximum indication of a wattmeter that operates on a thermal principle and is very slow in its response.

(d) Periodic tests by the power company, using one of the above meters.

(e) Installed horsepower.

Sometimes only the demand during certain hours of the day is considered, or the day and night demands may be considered separately, meters having the necessary features being used.



JOHN F. MOORE

Electrical engineer; graduated with honors from the University of Toronto in 1932. Got his early industrial experience with the Hydro-Electric Power Commission of Ontario and Benjamin Electric Manufacturing Company. Joined Dunlop Tire & Rubber Goods Company in 1934.

3. Either *(a) kilowatt-ampere demand,* or *(b) power factor.*

The kva. demand is the arithmetic product of the potential and current demands. It is usually measured by suitably connecting some form of kw. demand meter. When so connected the meter indicates correctly only at one particular power factor. As the power factor differs from this particular value the meter records less than the true kva. Under extreme conditions this difference may be great.

Power factor is the ratio of the true power or kw. to the apparent power or kva. It may be measured by a graphic power factor meter or determined from periodic tests by the power company. On all loads of considerable magnitude the meters are not direct-reading; hence their indications must be multiplied by a factor. This factor is marked on the face of the meter.

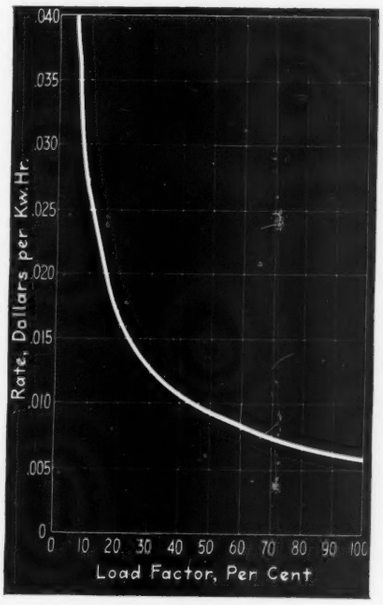


Figure 2. Importance of maintaining a high load factor is evident from this curve, which shows the relation between the rate per kilowatt-hour and load factor

The next step is to study the power contract until its terms are fully understood. If any terms are not clear, ask the power company to explain them. Find out the hours of the day during which the demand is measured, and how it is computed; the exact manner in which the power factor is determined, and so on. Ascertain what special discounts may be offered. Investigate the possibility of using cheap, off-peak power.

Analyze the method of computing the power bill and reduce it to its simplest terms. If possible represent it graphically. For comparative purposes record its monthly values.

For example consider an industrial plant where a kilowatt-hour meter, a kw. demand meter, and a kva. demand meter are employed, the system of billing being as follows:

Service Charge

First 10 units of billing demand, $1.50 each per month.

Remaining units of billing demand, $1.00 each per month.

The billing demand to be either the kw. demand or 90 per cent of the kva. demand, whichever is the greater.

Energy Charge

First 50 hours use of billing demand, $0.02 per kw.-hr.

Second 50 hours use of billing demand, $0.01 per kw.-hr.

Next 300 hours use of billing demand, $0.005 per kw.-hr.

Remainder, $0.0025 per kw.-hr.

All the above subject to 10 per cent discount for prompt payment.

Meter rental, $5 per month.

When billing demand used for more than 400 hours, the power bill equals:

$\$5 + 0.9\ [1.50\times10 + 1.0(D-10) + 0.02(50D) + 0.01(50D) + 0.005(300D) + 0.0025(E-400D)]$

$= \$5 + 0.9\ (5 + 3D + 0.0025E)$

$= (\$9.50 + 2.7D + 0.00225E$

Again, when billing demand used between 100 and 400 hours, the power bill equals:

$\$5 + 0.9\ [1.50\times10 + 1.0(D-10) + 0.02(50D) + 0.01\ (50D) + 0.005(E-100D)]$

$= \$5 + 0.9\ (5 + 2D + 0.005E)$

$= \$9.50 + 1.8D + 0.0045E$

Per Cent Load Factor = (*Average Load*×100) ÷ *Maximum Load* = $100E \div$ (Hours per Month × D) = $0.137\ E \div D$, approximately, in this instance.

Rate per kw.-hr. = cost per month ÷ Kw.-hr. per month.

The relation between rate and load factor is shown in Figure 2 for the plant under consideration.

The effectiveness with which the monthly demand is employed is the operating efficiency. In per cent:

Operating Efficiency = $100E \div$ (*Working Hours per Month* × D). A record of the monthly operating efficiency should be plotted as Figure 3 shows.

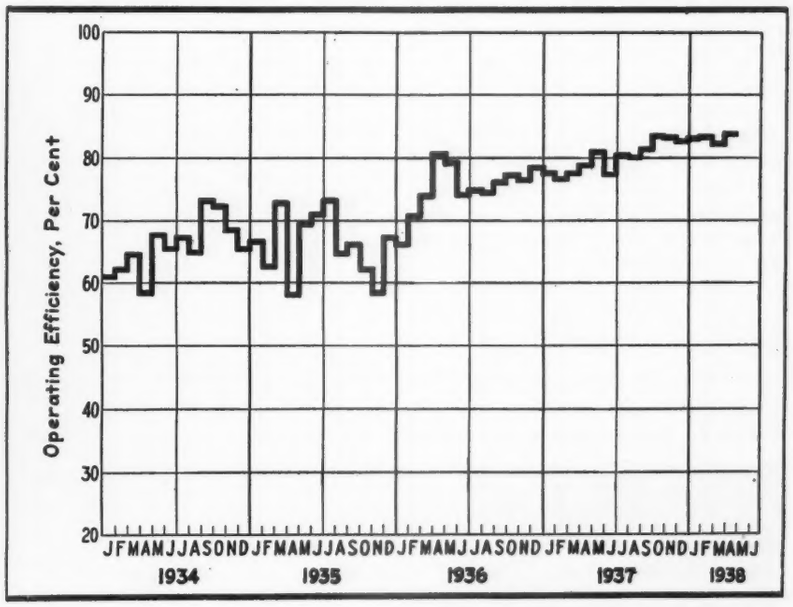

Operating Efficiency, Per Cent
100
90
80
70
60
50
40
30
20
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J
1934
1935
1936
1937
1938

Figure 3. Operating efficiency in this plant has gone up considerably during the past two years, much of the credit for it being due to closer limitation of demand

Study of the monthly analysis of the power bill frequently will show the direction in which savings may be made. In general there are three ways, all of which may or may not apply to any one plant. These possibilities are: (1) Reduce energy consumption; (2) reduce demand; (3) improve power factor.

1. To reduce energy consumption:

(a) Reduce extraneous losses. Whenever possible measure the efficiency of the driven machines and determine what portion of the input is wasted in unnecessary losses. Keep friction in line-shafting, conveyors, and all pieces of equipment to a minimum. Avoid excessively tight

belts. Use anti-friction bearings whenever possible. Give special consideration to losses which occur over long periods, no matter how insignificant they may appear. Determine the annual cost of each loss and what steps are justified to reduce it.

(b) Pay close attention to lubrication. Deficient lubrication causes excessive energy losses as well as excessive wear. Use the correct lubricant for each piece of equipment. Excessively heavy lubricants in such devices as gear boxes tend to introduce large losses.

(c) Use the correct size and type of motor for each application. Do not use special-purpose motors for drives for which they are not suited. Determine the size and nature of each load. Replace existing motors with others of more suitable size or type wherever such changes are indicated.

(d) Simplify the mechanical power drive. Avoid driving through a multiplicity of belts, chains, gears, and other elements. Even the comparatively small losses of a good transmission layout mount up by the end of a year.

(e) Investigate the relative economies of group and individual drives. It is usually economical to group several fluctuating loads on one drive. Find out whether you have any motors which do practically nothing all day but drive a lot of lineshafting; if so, consider individual drives.

(f) Use sufficient equipment and operate it under the conditions for which it is designed. When this is not done, fans, pumps, and other equipment may be very wasteful of power.

(g) Revise processes to require less power. For example, warming the ingredients in a mixer may greatly reduce the power required. Speeding up or slowing down a process may reduce the energy required to perform it.

(h) Make sure that electrical equipment is operated on the voltage for which it is designed. Operation under other conditions is uneconomical in one way or another. This is particularly true of incandescent lamps. A slight undervoltage greatly decreases light output per watt input. A small overvoltage greatly decreases lamp life.

(i) Check up the lighting system. Whenever practicable paint interior surface a light color. Use properly designed and placed lighting units, and keep them clean. Provide adequate illumination for each job. Do not have high-intensity illumination over areas not requiring it. Lay out circuits so that only the necessary lamps need be turned on. See that all others are kept off.

(j) Reduce copper losses. Keep feeders, particularly those carrying low voltage, as short as possible. Locate step-down transformers close to the load to obtain the minimum distance of transmission at the lower voltage.

Use the highest voltage practicable for motors and other equipment. Star-connecting 120-volt lighting circuits allows most of the distribution to be done at 208 volts, three-phase.

Put in ample-sized conductors. The reduced losses will pay for the additional cost. Many plants suffer from the use of feeders of inadequate size.

Keep the distribution system as simple as possible. Eliminate unnecessary switchgear. Check switches, fuse clips, and contactors, to make sure that they are in good condition.

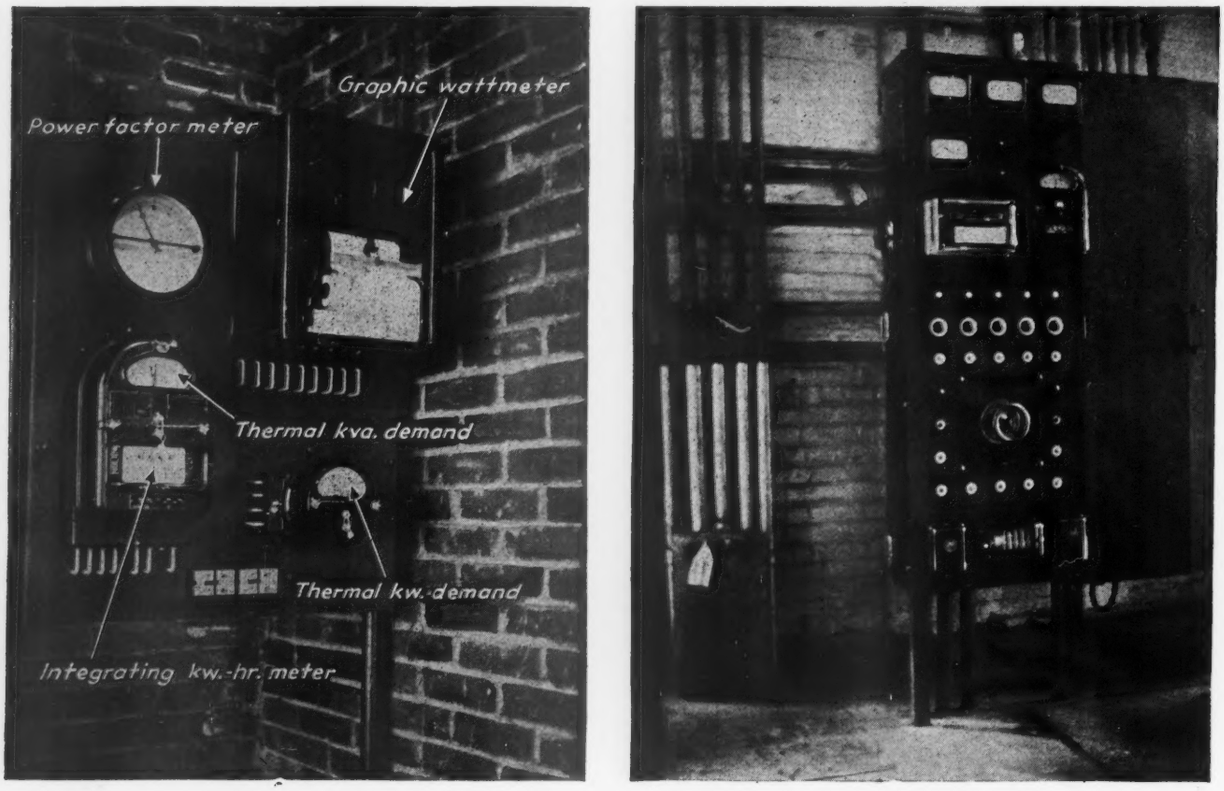
2. To reduce kw. demand:

(a) Schedule work so as to keep the power required as uniform as possible. For this purpose determine the power required by each machine for each operation. Note the power required on the production scheduling cards or charts.

(b) Regulate the demand to any desired value by manually or automatically cutting off load when neces-

(Continued on page 102)

Figure 4. The automatic demand control at the right was designed for operation with the billing meters shown at left



WHAT GREASES *for* HOT MOTORS?

A problem that isn't solved by guessing

A Bearing Engineers' Committee (B.E.C.) grease testing machine discloses facts that might be expensive if they had to be learned by actual trial

H. A. McCONVILLE

Works Laboratory, General Electric Company, Schenectady, N. Y.

GREASES that will give good satisfaction when used in motors operating within the normal temperature range of 32 to 175 deg. F. are quite plentiful. They may not be ideal from all standpoints, but they will lubricate without undue trouble. Step outside of this range and you run into a host of difficulties.

Let us first consider continuous operation at temperatures of around 200 deg. F. Use of calcium, aluminum, and zinc soaps in making these greases is of course prohibited, since the safe operating temperatures for greases with these bases is about 150 deg. F. Above this temperature the water used to combine the soap and oil is slowly driven off, causing breakdown of the grease and separation of free oil and soap. Therefore, only sodium- or sodium-calcium-soap combinations can be considered in the greases now available.

To a certain extent the flow point of a grease is a measure of the temperature it will stand in a motor, but this relationship does not always hold true. It is a quick means of distinguishing between a sodium- and a calcium-base grease, because the flow point of the calcium grease will seldom be above 210 deg. F. Sodium- or sodium-calcium-base greases may have flow points varying from 250 to 410 deg. F. in a consistency range suitable for use in motors, depending on the consistency and method of manufacture.

Two general types of greases are offered for high-temperature service. The kind most in favor for ordinary applications where resistance to heat is the primary object and starting and running torques are secondary, is composed of a heavy-viscosity oil of the steam cylinder type combined with a sodium soap. Such greases are mostly dark green or black in color. The heavy viscosity of the oil is noticeable when some of the grease is placed in the palm of the hand and worked with a finger. For slow-speed bearings and temperatures up to 275 deg. F., they are usually best.

When Temperatures Drop

If the temperature ever drops much below 32 deg. F., however, they are likely to give serious trouble. When the grease breaks down because of heat or oxidation, the bearing is gummed up much worse than it would be with a grease containing a lighter-viscosity oil. The heavier, darker-colored petroleum fractions usually are more easily oxidized than the lighter fractions.

The other type of grease uses an oil of lighter viscosity, in some instances as low as 280 to 300 seconds at 100 deg. F. Color may vary from almost pure white to amber and darker shades. To obtain the same consistency in these greases, the soap content must be much higher than in the type previously mentioned, ranging from 15 to more than 30 per cent in the grades that can be used for motor lubrication.

Both sodium and sodium-calcium soaps have been used, the straight sodium grease giving the highest flow points. It has never been proved, however, that a sodium-base grease can operate continuously at any higher temperatures than the mixed-soap-base type. The process of manufacture of the grease and the percentage of caustic soda used to the fats and fatty acids present in making the

sodium soap influence the flow point and stability of these greases.

Although very stiff greases have been made for use in locomotive driving journals operating at high temperatures, these products are not suitable for motor lubrication of the type under consideration.

It has been said that as the temperature rises above 200 deg. F. the rate of oxidation of an oil or grease is doubled for every rise of about 15 deg. F. Indications are that oxidation is slow up to about 220 deg. F. and increases rapidly above that point. Certainly a grease can be no better than its constituents, so far as resistance to temperature is concerned. If the oil used in a grease will darken and oxidize at the temperature it is subjected to, the grease will not be satisfactory.

Assume that a grease is desired for use where the bearing temperature may reach 300 deg. F. How can it be selected without actual trial in a motor, possibly at the risk of spoiling some bearings?

The first and simplest test is to put some of the grease in a clean porcelain crucible and place it in an oven at a temperature of 300 deg. F. If the oven is not air tight and there is some circulation, oxidation will proceed more rapidly. Most greases will blacken and turn acid in less than one day's exposure to this temperature.

For the next test pack the grease in all-steel bearings, place them on watch glasses, put in the oven, and note the length of time required for darkening. Besides the appearance of the grease, increase in stiffness is noted, using test apparatus designed for that purpose and described in the *General Electric Review*, May, 1937. In addition, increase in acidity in the grease in the bearing over varying periods of time can be determined.

Try It on Bronze

Now the grease should be subjected to the same tests in a bearing using a bronze retainer. Greases which will successfully stand 300 deg. F. in an all-steel bearing will go to pieces in two days' time in the presence of bronze. It can safely be said that no grease is available on the market which will remain stable under these drastic conditions. If one were found, however, the next step would be to put it in a bronze and steel bearing operating in a motor, which imposes still more severe conditions since the oxidation of grease has a tendency to increase under agitation and with occlusion of air by the grease.

What elements in the grease are least stable at high temperatures? Is the oil or the soap responsible for the breakdown which occurs? What can be done to overcome these drawbacks? In an attempt to answer these questions some of the most stable oils available on the market, including colorless refrigerator oils, were placed in porcelain crucibles in an oven at 300 deg. F. The best of these oils lasted two or three days before turning black, while the refrigerator oil took nearly a week to darken to a dark brown color.

Unless there are still better oils available, it would seem that the oil used in the grease needs some addition to stabilize it against heat.

I believe that there are at least two separate reactions which take place in a lubricating grease when it is subjected to a temperature in excess of, say, 220 deg. F. There may be a darkening of color due to chemical changes, or the formation of dark chemical compounds, without noticeable increase in acidity. This may, however, be the initial stage of oxidation, before the product has reached the point at which organic acids are formed. Darkening of color can be prevented or at least retarded considerably by the use of certain anti-oxidants.

In the other case there may be free organic acids formed without noticeable change of color. This reaction may also be retarded by suitable additions, which will not, however, stop the darkening that may take place later. The solution may be an ideal anti-oxidant which prevents both reactions, or else a combination of two anti-oxidants which will not react chemically with each other when added to a grease.

Although soap alone may darken or even burn black at a temperature of 300 deg. F., when it is mixed with oil there is less tendency for this action to take place. In many instances it has been found that in greases which have turned black, the soap left behind is white in color after the oil has been dissolved out, although this is not always true. I believe, however, that if the oil used were ideal from the standpoint of stability in the presence of heat, a solution of the problem would be considerably closer.

Metals with which the grease comes in contact play a highly important part in contributing to its chemical instability, especially where higher temperatures are concerned. The presence of dissimilar metals is not needed to produce this effect; therefore electrolytic action cannot be considered seriously unless the impurities within the metal itself are considered as focal points for causing electromotive reactions.

The change in the grease seems to be an oxidation phenomenon because when darkening takes place, this darkening starts at the outer exposed surfaces and progresses inward. A large mass of grease may have its exterior surface blackened and be acid in reaction while the center of the mass will be unchanged. If the components from which the grease was made would not stand the temperature involved, the grease would be blackened all the way through.

Not too Thin, When Hot

When a grease has been found which will not darken and oxidize when simply in contact with metals which may be used in bearings, the next step involves similar tests after the grease has been thoroughly worked in a bearing. Usually after a grease has been agitated and has whipped up air, the tendency to oxidize is greatly enhanced.

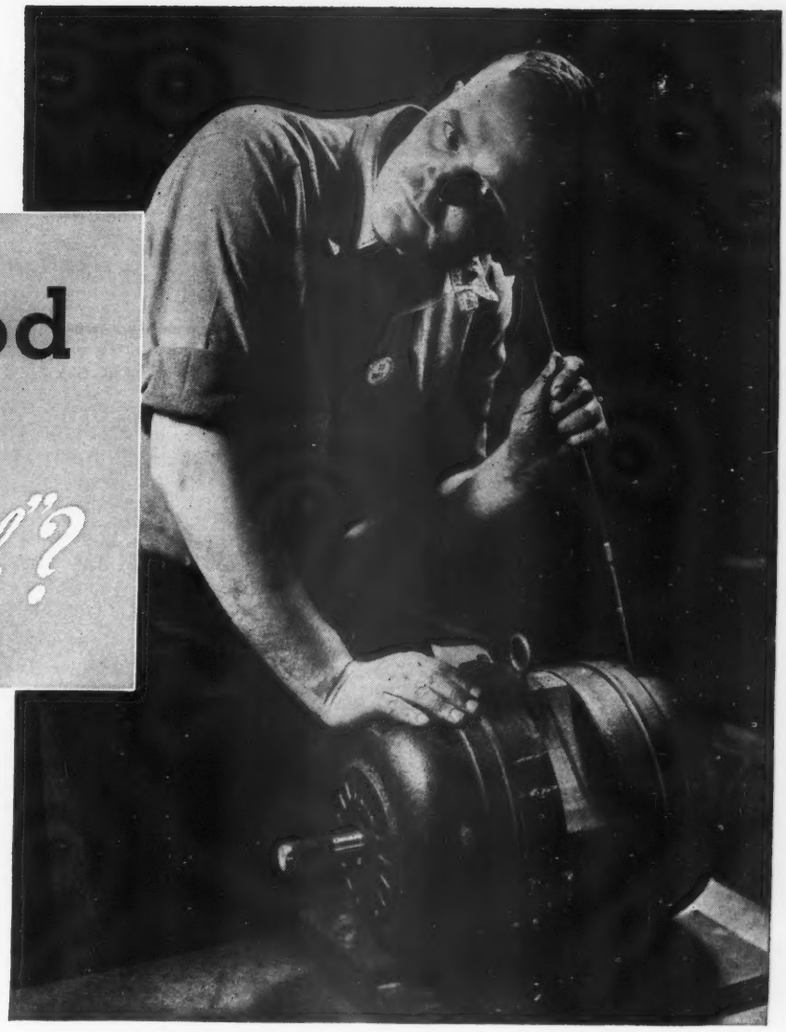
Another point to watch very closely is the loss of consistency at higher temperatures. At a temperature above 220 deg. F. most greases have a tendency to become very thin. As a result they are not heavy enough to remain in the bearing, but will leak out along the shaft and get splashed on the windings. This action of grease at high temperatures can be observed to some advantage in the B.E.C. grease testing machine. When a bearing in use in this machine is shielded on the lower side, and the grease

(*Continued on page 100*)

THE AUTHOR

A New Englander from Northampton, Mass. Came to GE 10 years ago. Specializes on lubricants, papers, and other insulating materials. A graduate of Worcester Polytechnic Institute (B.S., 1919), he served as chemist with Nordyke & Marmon and Atlas Crucible Steel Company. Established chemical lab at Rolls-Royce of America in 1920, stayed there until the company discontinued the work in 1929. Member, A.S.T.M., S.A.E.; chairman, Committee on Gear Lubrication, American Gear Manufacturers' Association. Plays tennis, collects stamps, is an ardent genealogist.

How Good Is "Good Enough"?



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You want to know

more about the items mentioned on this page. Letters to the addresses given will bring information

• PAPERS presented at the twenty-first Silver Bay Conference on industrial relations have been published in a summary report. Copies can be obtained for 75c. from Industrial Service, National Council of the Y.M.C.A.'s, 347 Madison Ave., New York.

• HORIZONTAL, vertical, upside down, or angle positions are all the same to a portable drill stand when it's hooked up with a magnet that holds it securely and accurately in any position. Magnet has 900-lb. pull, works on a.c. or d.c. Stearns Magnetic Mfg. Co., Milwaukee.

• LIST of 63 recent books on air conditioning, with particulars as to their contents, publishers, and prices, has been compiled by National Research Council, Ottawa, Canada. Copies are 25c. each.

•SOCIAL SECURITY is here to stay, but its present set-up is far from perfect. That's what most Americans think, and the conclusion reached by the Senate's Advisory Council on Social Security. Copies of the Council's final report can be obtained from its chairman, J. Douglas Brown, Industrial Relations Section, Princeton University, Princeton, N. J.

• LOCK WASHER and machine screw come pre-assembled to save user's time and make certain that no screw is driven without a lock washer to prevent its loosening by vibration. Washer can't come off the screw. Shakeproof Lock Washer Co., 2501 North Keeler Ave., Chicago.

READ dimensions to 0.0001 in. at a glance with this indicating micrometer. Pressure on the small button at the bottom releases the bottom anvil, makes it movable so that the "mike" can be used as a comparator or snap gage. George Scherr Co., Inc., 128 Lafayette St., New York

• POUR POINT DEPRESSOR for engine oil makes possible more rapid lubrication on cold starts. The manufacturer recommends it as a crankcase antifreeze, too. The Curran Corp., Malden, Mass.

• INSTRUMENTS for measurement and automatic control have speeded up production, improved quality, reduced costs, and increased labor productivity, a government study finds. Write to Publications Section, Division of Information, Works Progress Administration, Washington, D. C., for a copy of their 148-page report "Industrial Instruments and Changing Technology."

• PRELUDE to attempted federal control of industrial pricing policies is what published results of a study sees in the work of the Temporary National Economic Committee, better known as the O'Mahoney "Anti-Monopoly Committee." Farrel-Birmingham Co., Inc., Ansonia, Conn.

• DO small electroplating jobs with a brush just as you would a touch-up paint job. Plating compounds, in eight metals, are of jelly-like consistency, are applied with dry-cell-connected brush. Rapid Electroplating Process, Inc., 1414 South Wabash Ave., Chicago.

• PUBLIC RELATIONS—to their better understanding a chart is offered, outlining the three steps of study, planning, and execution in all phases of public relations work. Haworth, Powell & Thomas, 30 Rockefeller Plaza, New York.

• DUPLICATOR, consisting of only the bare essentials to the process, attaches to table top or any wooden surface, makes up to 100 copies from typewritten or hand-lettered original. Morgan-Dillon Co., 5154 North Clark St., Chicago.

• SAWS AND KNIVES, circular, have clearance between teeth and cut material. Beginning at the outer edge, the surface is ground out to relieve the cutting edge, and prevent heating of the tool and burning the material. E. C. Atkins and Co., 436 South Illinois St,. Indianapolis.

• "MACHINES and Tomorrow's World," a pamphlet based on a report to the National Resources Committee by its Subcommittee on Technology, shows what technology means to our lives, and points out need for planning for the future. For copies, send 10c. to Public Affairs Committee, Inc., 8 West 40th St., New York.

• SAFETY DEVICE keeps upward-acting rolling doors from banging down on persons or things. A door striking a man's head will not injure him, it is said, for as soon as bottom of the door makes contact, action is immediately reversed. Kinnear Mfg. Co., Columbus, Ohio.

• MOTION-STUDY MEN or training supervisors using films in their work will want to investigate a titling machine on which titles or sketches can be made while camera is grinding out the film. Bell and Howell Co., 1801 Larchmont Ave., Chicago.

• FUME DETECTOR flashes red warning light when poisonous vapors are present. Absorption of colors characteristic to the vapors causes shadows to fall on photoelectric cell, actuating the warning. General Electric Co., Schenectady, N. Y.

• BINS will never be empty with the "Tellevel" automatic storage control there to start feeding conveyors or elevators when material level is low, and shut them off when bin is full. Stephens-Adamson Mfg. Co., Aurora, Ill.

• HUMIDIFIER for rooms up to 4,000 cu. ft. automatically maintains relative humidity desired. Comes in unit assemblies, operates from lighting circuit. Spray Engineering Co., 142 Central St., Somerville, Mass.

• THE PAST YEAR has brought much talk of the syphilis problem in the United States. What's it all about, how does it affect industry, what's being done about it? For the answers send 10c to the Public Affairs Committee, Inc., 8 West 40th St., New York, for their pamphlet, "Behind the Syphilis Campaign."

SHIN PROTECTORS can be worn outside or inside of trousers. Made of fiber, they have two sponge rubber pads on their inside surface to absorb shocks and make their wearing comfortable. Ellwood Safety Appliance Co., Ellwood City, Pa.

How to do it?

Here are some recent G-E developments that may help you

TEST INSULATION QUICKLY

Just plug this device into a standard outlet, and you have a very convenient method for the testing of insulation of motors, appliances, etc. Output voltage can be varied from 500 to 3000 volts. It is safe, accurate, and easily portable. Use coupon and write today for publication GEA-3104.

MAKE YOUR WIRING OIL-PROOF

Ever have trouble with oil attacking rubber insulation? Here is a wire, insulated with FLAMENOL, that won't burn; it resists oil, acids, and alkalis. It's ideal for wiring machine tools and other high-grade equipment. Ask for our Bulletin, GEA-2733, which gives details.

CHECK FOR PHASE-ROTATION

You can save time with this phase-rotation indicator—predict direction of rotation of motor drives, check connections for paralleling generators, transformers, and buses, and check connections on meters, relays, and rectifiers. Easy to use. No moving parts. Ask for GEA-2264.

REGULATE SECONDARY VOLTAGE

A new line of G-E air-cooled regulators greatly widens the field of application in which uniform voltage control can be obtained economically. You can now have constant voltage on long secondary runs regardless of fluctuations in power load. You'll miss a good bet if you don't find out about these new regulators. Publication GEA-3057.

GENERAL ELECTRIC

General Electric, Dept. 6-201
Schenectady, N. Y.

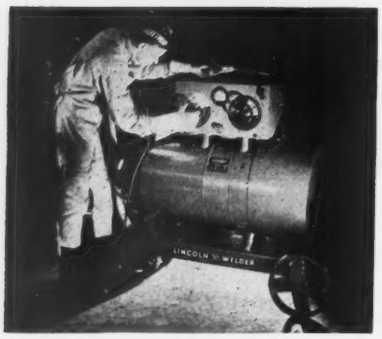
I should like to have more information on the products checked. New Insulation Tester, GEA-3104 ☐ . . . . Oil-proof Wire GEA-2733 ☐ . . . . Phase-rotation Indicator, GEA-2264 ☐ . . . . New Voltage Regulators, GEA-3057 ☐ . . . . .

Name .....
Address .....
City ..... State 96-560

What's New in Equipment

Welders

"Shield-Arc" welders have self-indicating dual continuous control-job selector, and current control calibrated and equipped with dials indicating type of work and number of amperes for settings. Operator can vary slope of



volt-ampere curve and amount of welding current independently and positively to suit the job. Both voltage and current control are continuous in operation, providing many combinations of voltage and current resulting in wide welding range. Other features: Control can be advanced or retarded in fine increments, self-protected motor on a.c. welders to permit sustained operation with large-sized electrodes at high average welding currents without danger of burnout, separate excitation of generator. Available in a.c. and d.c., belted and coupled, gasoline and diesel engine driven types, in standard ratings. The Lincoln Electric Co., 12818 Coit Road, Cleveland.

Floodlights

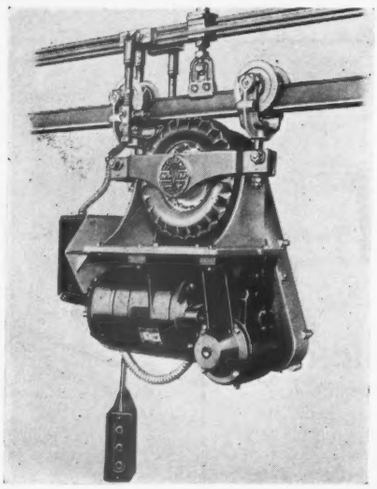
No. 1052CA "Red Cap" Flood-Lite is a 750-1,000-1,500-watt, open-type floodlight finished by the Alzak process and available in both specular and diffused surfaces with beam spreads ranging from 15 to 100 deg. Can be furnished with heat-resisting lenses, clear-plain, 30-deg. spread or diffusing; glare shields and spill light reflectors are available as accessories. S & M Lamp Co., 119 West 36th Place, Los Angeles.

Counting Unit

Complete with photo electric cell relay, light source, power supply and counter, the Type PC-3 Photo Electric Cell Counting Equipment is said to be accurate to 600 counts per minute. Its tube life is estimated at 7,000 to 10,000 hours. Polarized plug connections for cables increase usefulness of equipment on multiple installations permitting photo-electric cell amplifier and relay to be removed for check or replaced in several seconds. Lipman Engineering Co., 415 Van Braam St., Pittsburgh.

Fireproof Blanket

A fireproof blanket 80 in. long, made of mothproofed wool, for protection of laboratory and industrial workers, is wound on a vertical roller mounted on a wall or post. To extinguish flames in his clothing, a worker need merely thrust an arm through a catchrope attached to exposed edge of blanket and, turning rapidly, wrap the blanket closely around himself. May be used to blanket out small fires. Davis Emergency Equipment Co., 55 Van Dam St., New York.



Conveyor

"MotoVeyor," for transporting loads by an overhead track system. Has a speed range of 60-600 ft. per min. Negotiates inclines and is built to maintain a uniform speed going down grade. Main frame is cast in one piece with motor under frame. Balanced without use of counterweights. Rubber tire is utilized for drive wheel. Ball bearings located on each side of wheel support the drive shaft. May be used in power-driven cranes or built into cab or step on platform. The Louden Machinery Co., Fairfield, Iowa.

Spotlight

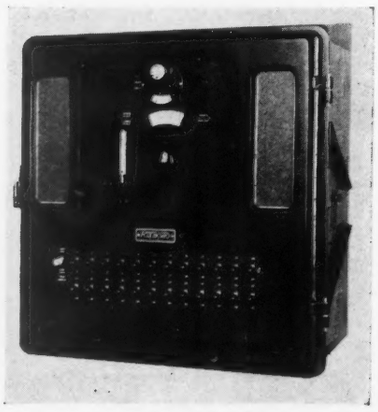
Sealed-in spotlight that is said to retain maximum reflecting efficiency throughout its 1,000-hr. life. For use in close inspection work and for lighting up wide areas on machine units. Uses the Mazda projector bulb with reflector and lens built in. Is compact, small, and easily portable. Mitchell Mfg. Co., 1550 North Dayton St., Chicago.

Speed Reducer

"Radicon" speed reducer, developed by David Brown & Sons of Huddersfield, England, is being introduced in the United States by a distributor who has exclusive rights for this country. A worm-gear type, it is built compactly, designed for low-running costs. Cooling is said to be highly efficient. Leakage from the automatic, continuous oil-circulating system is prevented by double-wall oil baffles and flingers. Comes in several sizes. Thomas Prosser & Son, 120 Wall St., New York.

Potentiometer

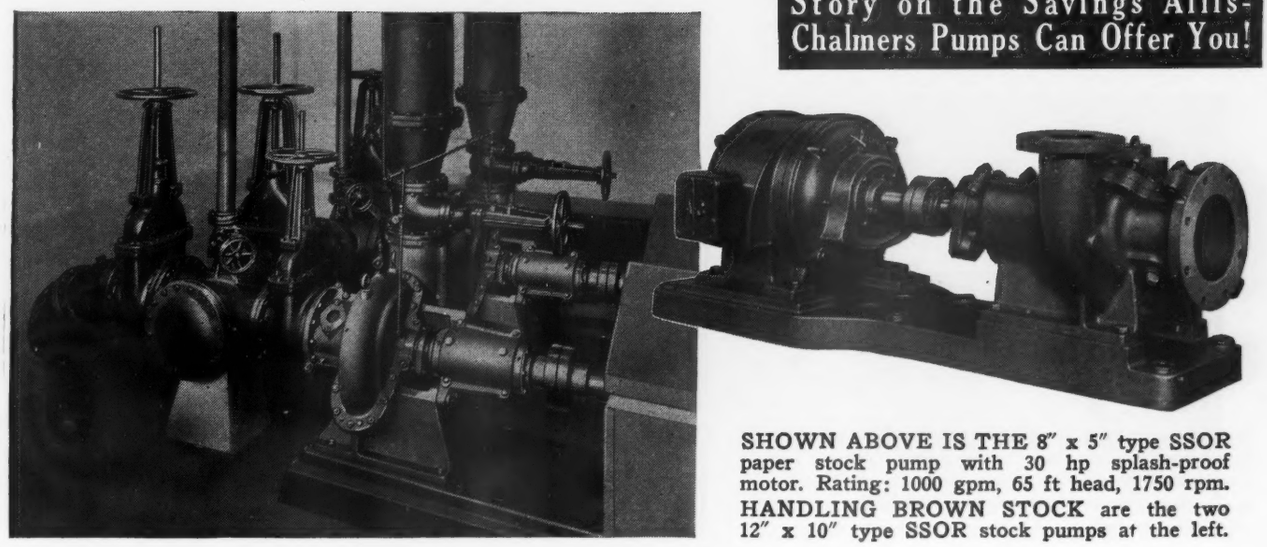
Key-switch cabinet indicating potentiometer with as many as 82 switches provides centralized temperature indication for scattered points in a plant. Is equipped with an indicating panel containing a 17-in. scale, vernier dial-knob,



and vernier-type rheostat. The instrument may be used with either single or double range for one or two types of thermocouples, and with scales calibrated in 1-1,000 deg. F., in degrees

SAVES $3,700 PER YEAR

Large Paper Mill Replaces Out-Dated Pumps With Modern Allis-Chalmers Pumps! New Pumps Pay For Themselves! Get the Whole Story on the Savings Allis-Chalmers Pumps Can Offer You!



SHOWN ABOVE IS THE 8" x 5" type SSOR paper stock pump with 30 hp splash-proof motor. Rating: 1000 gpm, 65 ft head, 1750 rpm. **HANDLING BROWN STOCK** are the two 12" x 10" type SSOR stock pumps at the left.

When profit margins narrow . . . when materials increase in price . . . you've got to cut your operating costs! You've got to replace out-dated equipment . . . old pumps that may still give service but that cost too much to run . . . with new, improved equipment . . . with Allis-Chalmers Pumps!

A large paper mill, with Allis-Chalmers engineering assistance, has just replaced seven old, outdated pumps with six new pumps of the latest design. The old pumps took 320 bhp to do their work . . . but the new pumps use only 159 bhp—a saving of 161 bhp!

Each horsepower saved represents $23. The actual money saved per year by this replacement will amount to $3700! Yet the complete installation of the new pumps cost only $4800—the pumps will pay for themselves in less than a year and a half! And they'll go right on making that saving . . . $3700 a year . . . for years to come!

Find Out How You Can Save!

That's another case history from Allis-Chalmers' files. Another example of the way Allis-Chalmers Centrifugal Pumps slash operating costs . . . cut overhead . . . make possible a wider profit margin!

Get the whole story. Find out why Allis-Chalmers pumps *can* cut your pumping costs. Learn the advantages of undivided responsibility—of one contract for both pump and drive. Learn what Allis-Chalmers engineering . . . testing and research facilities . . . can mean to you in getting the right pump for the job you want done.

Get the facts. There's an Allis-Chalmers representative near you. There's an Allis-Chalmers man . . . a trained pump engineer . . . ready to show you how to cut your pumping costs . . . to slash dollars from your overhead. He's the man to see! Get in touch with him!

931

CENTRIFUGAL PUMP DIVISION

ALLIS-CHALMERS

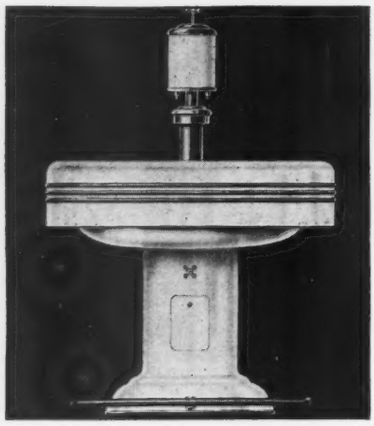
MILWAUKEE · WISCONSIN

SINGLE-STAGE DOUBLE-SUCTION PUMPS • CLOSE-COUPLED SINGLE-STAGE SSUnit PUMPS • MULTI-STAGE PUMPS • PAPER STOCK PUMPS • MIXED FLOW AND AXIAL FLOW PUMPS • AND SPECIAL DESIGNS FOR UNUSUAL APPLICATIONS

Centigrade, or in millivolts. In checking, a coil of constant resistance value can be substituted for the automatic cold junction compensation coil. The instrument case is of pressed steel, universal type. All switches and the rheostat are totally enclosed. The Foxboro Co., Foxboro, Mass.

Lighting Fixtures

Five models of Canopy Localites are available for use with fluorescent lamps. The different models cover overhead, bench or table, portable-floor, and trolley-track installations. All use the same canopy and lamp assembly, and each is fully equipped with wiring, sockets, and switches, ready for installation of two 18-in., 15-watt fluorescent lamps. Canopy is 13¾ in. wide, 20 in. long, and 5 in. deep, and contains two magnetic switches and two sockets. The Fostoria Pressed Steel Corp., Fostoria, Ohio.



Washfountain

Designed especially for small or narrow washrooms, the washfountain is wall type, semi-circular, 36-in. diameter, hand or foot controlled. Accommodates three people. Stainless steel units have stainless steel bowls with pedestals of either enameled pressed iron or solid stainless steel. Fixtures of enameled pressed iron units are of steel, finished in acid-resisting vitreous enamel, with pedestals of steel, synthetic enameled. Exposed fittings, except foot-rails, are of heavy brass, chromium plated. A complete outfit includes self-cleaning sprayhead, manually operated mixing valve, cake soap tray. Sectional sprayheads, thermostatic mixers, and liquid or powdered soap dispensers are extra. Bradley Washfountain Co., North 22d & West Michigan Sts., Milwaukee.

Pouring Ladle

Electric pouring ladle for solder with supporting stand, pours by turning handle to tip pot without removing ladle from stand. Spring action in stand is provided to prevent accidental tipping of the pot. Replaceable unit inside cup holds approximately 1½ lb. of solder. Is rated at 200 watts on 115 volts. Vulcan Electric Co., Lynn, Mass.

Foot-Candle Meter

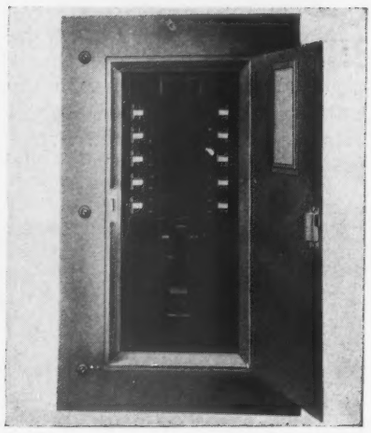
"Photomet," designed for illumination measurement, offers the illumination engineer, photographer, and laboratory technician a wide variety of sensitivities and ranges. Case approximately 9x5x5 in. The photocell is attached to a microammeter by a flexible 8-ft. cable. No batteries necessary. The scale has 50 divisions and is numbered with four ranges. Available in a variety of sensitivities and ranges. G-M Laboratories, Inc., 1733 Belmont Ave., Chicago.

Vibration Dampeners

"Universal" vibration dampeners, for application to electrically driven accounting machines, may be installed without alteration of the machines and without removing them from their present location, or putting them out of service for a great length of time. Made of specially compounded rubber, inserted between feet of machines and floor, dampeners eliminate vibration in buildings and reduce mechanical noises. They also protect machines from shocks and vibration from other sources. The Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Circuit Breaker Panel

Square D "Multi-breakeR" panelboards, Type NMM, are available with main circuit breaker or with main lugs only. Can be had with any number of single-pole or double-pole breakers in branches, except that any one panel is limited to 40 breaker poles. Several types available, all equipped with adjustable mountings, that interiors and trims may be set plumb in the box and flush with the wall surface. Square D Co., Detroit.



Metal Spray Gun

Metal spray gun with heat furnished by a blow torch. Has instantaneous control of spray from fine to coarse and on or off. Any standard rods or bars of solder may be used. Low air pressure and volume required. Has reserve of molten metal to maintain temperature under heavy use. Designed for use on automotive body work, rust proofing, fire protective covering, corrosion protection, covering non-metallic objects for plating and oxidizing. The Turner Brass Works, Sycamore, Ill.

Conveyor Idler

Type 90 troughed anti-friction idler for belt conveyors handling materials of medium weight, designed for conveyor widths of 14-24 in. Rolls are 4 in. in diameter, fitted with ball bearings, mounted close together in reinforced steel brackets welded to a mine-tie base to avoid creasing of the belt. Ends of base have slotted holes to facilitate adjustment on the supporting framework. Roll shafts have slotted ends to insure locked seat in roll-supporting brackets. Entire unit is of light all-steel construction.

Type 91 return roll idler is supported by reinforced steel hangers having slotted openings which act as seats and anchors holding the necked roll shaft in place. Link-Belt Co., 307 North Michigan Ave., Chicago.

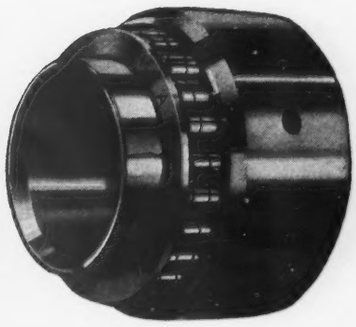
Hand Lamp

Insulated, non-conductive, portable hand lamp, designed for use where a metal lamp guard constitutes a hazard. Consists of insulated guard, molded rubber handle with solid core of live rubber, fiber hook, heavy-duty socket insert with strain-relief clamp. Is waterproof and heat resistant. Cylindrical open-end guard is supported by round, composition, moisture-resistant dowels that do not obstruct light nor cast shadows. An eye shield protects user's eyes from glare. No tools needed for lamp replacements.

HYATTS Help Keep

your equipment from growing old

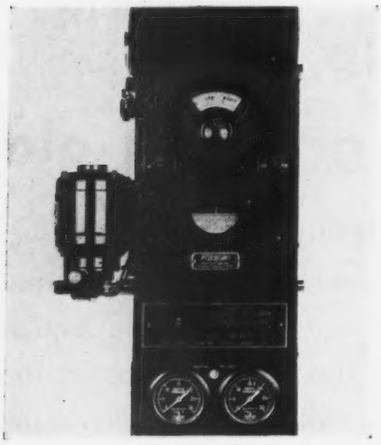
HIDDEN away in hoists, trolleys, cranes, trucks, conveyors and other material handling equipment, Hyatt Roller Bearings run easily, accurately, silently... giving many extra years of bearing satisfaction...with least attention ...keeping equipment from growing old. That's why so many leading equipment builders use Hyatts and why you should look for them in the specifications before you buy. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey, and San Francisco. Hyatt Roller Bearing Sales Company, Chicago and Pittsburgh.



In **HI-LIFT ELECTRIC HOISTS**, built by the Northern Engineering Works, Detroit, Hyatt Roller Bearings are used throughout the hoist and travel mechanism for higher efficiency, minimum of power, and freedom from bearing wear and care.

HYATT *Roller* BEARINGS

Takes standard or mill-type lamps up to 60 watts. Industrial Products Co., 2795 North 8th St., Philadelphia.



Pyrometer

Potentiometer control pyrometer for actuating air-operated valves which are unaffected by dampness, oily vapors, and corrosive atmospheres, and free from arcing and sparking electric contacts, are applicable to gas, oil, steam, hot water, and hot air heating, or brine, cold water, or air cooling systems. By a fixed setting of the temperature dial and slide wire contact position, the mechanism for detecting temperature change acts directly in detecting galvanometer deflection. Range of the 12-in. scale is —300 to +2,800 deg. F. Equipped with automatic safety shut off.

Air control system consists of a positive, open-and-shut air control mechanism, recommended air pressure being 17 lb. per sq. in. Valves are provided in both single- and double-seated balanced types. The Foxboro Co., Foxboro, Mass.

Pillow Block

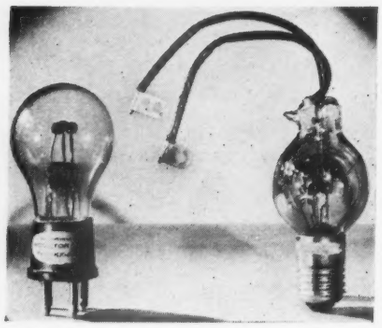
"Rubberflex" pillow block is available in ¾- and 1-in. shaft sizes. The unit comprises a self-locking, self-aligning bearing, and requires no machining of the shaft. The bearing is encased in a pressed steel housing equipped with felt seals. Bearing and housing are surrounded with sound-absorbent elastic material specially treated to make it impervious to oil and grease. Is capable of carrying substantial loads under nearly all operating conditions. The SKF Industries, Inc., Front St. and Erie Ave., Philadelphia.

Lift Truck

A small compact lift truck, "The Mighty Midget Mobilift," is capable of handling one-ton loads into and out of freight cars and motor trucks. With a lift of 9 ft. 6 in. to underside of load, it piles materials 14-15 ft. high, lifting and piling in one operation. Length of load arms is 24 in., tires are solid rubber, wheel base is 42 in., speed forward or reverse is 3½ m.p.h., weight is approximately 2,600 lb. Vaughn Motor Co., Portland, Ore.

Protector Tubes

Gas-filled protector tube, for indoor service, protects supervisory control line wires and telephone lines from overvoltages caused by lightning and direct contact with or induction from nearby



power lines. Line wires may be continuously grounded through suitable transformers in conjunction with the protector units. One electrode is connected to ground and the other two to the lines being protected. When an abnormal voltage disturbs the line, the tube breaks down and discharges the disturbance to ground, ceasing to discharge when the voltage of the disturbance is reduced. Westinghouse Electric & Mfg. Co., East Pittsburgh.

Fuel Consumption Meter

"Akraflo," a meter that measures and records by volumetric displacement, consists of a positive displacement meter and recording dial. Designed to check fuel consumption of trucks, tractors, industrial engines, and other equipment, when starting, accelerating, at slow, idling, and cruising speeds, thus providing data for checking and controlling operating costs, motor and fuel performance, etc. To be installed in fuel line, between pump and carburetor. Is 8½x5x9 in., weighs approximately 8 lb. Recording dial may be built into meter or installed on dashboard. S. F. Bowser & Co., Inc., Fort Wayne, Ind.

Electric Valve

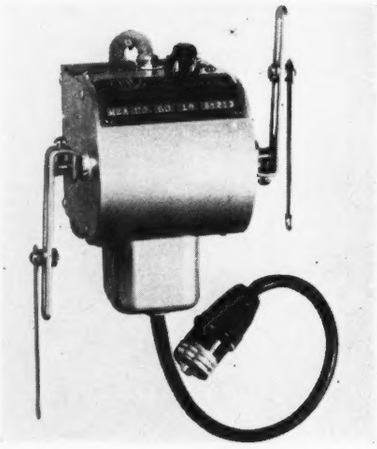
No. 101 electrically operated valve, tightly seated by a spring-loaded leverage system connected to the armature of the solenoid, provides tight closure against water or fluid pressure up to 150 lb. Valve and seat are of stainless steel. Sylphon bellows eliminates packing. Slot-and-roller construction removes angular stress from valve stem and assures straight thrust of cone when seating. Is protected by built-in strainer. Discharge capacity ranges from 1,100 to 3,200 lb. of water per hour. Standard electrical rating is 115 volts, 60 cycles; coils for other voltages and frequencies are available. McDonnell & Miller, Wrigley Bldg., Chicago.

Welding Hose

"Twinweld" welding hose for conveying oxygen and acetylene in welding and cutting work, consists of two lines of flexible, cord-reinforced welding hose molded into one unit. It is interlined with a cord-reinforced, non-blooming, gas-resisting compound. To install, the hose is split far enough along each end of the joint line to form a "Y" at both tank and torch ends. Ferrules furnished with the hose are crimped to prevent further separation of the two hose. Available in any cut length or in continuous lengths as long as 500 feet. Hewitt Rubber Corp., Buffalo, N. Y.

Motor Operator

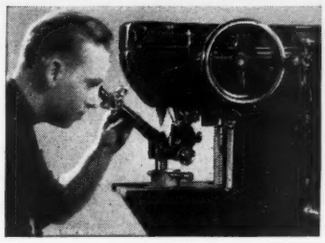
Damper motor to give effect to automatic control provided by Thermostats and similar control devices without recourse to electrical relays. Operates on low voltage supplied to the control circuit. Has auxiliary hand switches with "on," "off," and "automatic" positions to control heating and air-conditioning units. Types with 3-wire or 2-wire applications and with built-in or separately mounted transformers are available. Julien P. Friez & Sons, Baltimore, Md.



Electric Drills

Portable electric drills 581 and 341 have chuck capacities of ⅝ in. and ¾ in. and chuck speeds 290-420 and 240-380 r.p.m., respectively. The chuck is a 3-jawed, screwed-on-spindle type. The universal-type motor operates on commercial voltages and frequencies. Both drills have specially heat-treated nickel steel gears, are ball bearing, have combination breast plate and spade handle, and detachable pipe handle, and are equipped with an automatic release

300,000 OPERATIONS
AND STILL IN GOOD WORKING CONDITION
This veteran served five years on a heat recovery line, being partially opened and closed every four minutes seven hours a day for five years—exceptional service even from a valve of exceptional quality. A tribute to the practical applications of Crane research.



". . to unearth new facts"

Recently, the newly completed Crane Research Laboratories, housing the largest and best equipped research facilities in the industry, were opened to public view. In the foreword of a booklet published on this occasion, President Charles B. Nolte says:

"Research is misunderstood by a great many people, but in its simplest form it may be defined as an organized and diligent application of existing knowledge to unearth new facts. . . . Crane Co., therefore, is dedicated to the philosophy that only through continuing a well-organized program of research can it best serve its employees, its stockholders, the users of its products, and society in general."

TRANSLATING RESEARCH INTO DOLLARS FOR YOU

Crane research has as its objective the saving of dollars in your plant operation—the improvement of those valves and fittings whose responsibility it is to control all phases of flow.

Research in design and in new alloys has resulted in multiplying the life of valve stems—this improvement translated into longer life means dollars for you. Valve seats have greater resistance to erosion and corrosion because of research—and again research cuts your costs—saves you money.

Alloys have been developed capable of withstanding the searing cold of 150 degrees below zero—the scorching heat of 1300 degrees above, opening up new fields for you in the handling of liquids or gases at greater ranges in temperature. And in welding new alloys, Crane research has developed new techniques that make their use practical. Again this means increased production—more dollars in profit for you.

But research does not stop with these spectacular achievements . . . it also provides an accurate control of manufacture that guarantees the uniform, high quality of the valves and fittings you buy from Crane.

CRANE

CRANE CO., GENERAL OFFICES
836 S. MICHIGAN AVE., CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

safety switch with locking device. The Stanley Electric Tool Division. The Stanley Works, New Britain, Conn.

Fuse Puller

"De Luxe" fuse pullers are made of laminations of Bakelite. All metal parts are heavily cadmium-plated. Said to be tested at 35,000 volts dry, and 4,000 volts after 24 hours submersion in salt solution without moisture effects, either mechanically or electrically. Made in two sizes. Center pin or pivot is designed with screwdriver projection on the head, to be used when renewing ferrule-type fuses. Trico Fuse Mfg. Co., 5th St. at Chambers, Milwaukee.

Drain Cleaner

"Empire State Drainer Cleaner" is a hand-operated pressure pump for clearing drain pipe obstructions. May be applied to any type of drain system up to a 6-in. soil line. Operates on combination pneumatic and hydraulic principle; air pressure generated by hand may reach as high as 125 lb., and is released from the compression chamber by a simple trigger contact. Pressure released acts as a hammer blow against the drain obstruction. Empire State Drain Cleaner Corp., Empire State Bldg., New York.

Motor

Split-phase ⅛-hp. vertical motor (available in modified design for horizontal mounting). Constructed for continuous duty, has bearing design pro-

viding lubricant circulation and utilization of wick feed. Is semi-totally inclosed with air circulator for cooling. Has high starting and pull-out torque and thermal overload switch. Other features are dynamic balanced rotor parts and welded rotor connections. The Delco Appliance Division of General Motors Sales Corp., Rochester, N. Y.

Magnetic Clutch

Multiple disk magnetic clutch, style ED, designed on the duplex principle, operates two clutches, both magnetically energized with a single magnet. The unit can thus be operated in both directions simultaneously, making possible 2-speed, reversing, or 2-speed reversing drives. Collector rings are carried on the outside diameter, one ring being common to both magnetic coils. For use in carriage and rapid traverse operations, tool slide feeds, spindle, and other applications. Stearns Magnetic Mfg. Co., Milwaukee.

Hydraulic Action Controls

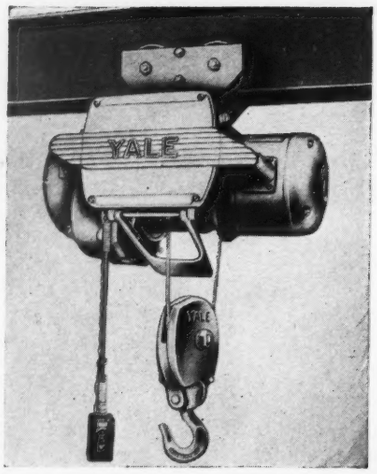
These controls embody two basic assemblies: (a) liquid-filled, sensitive element, (b) enclosed switch mechanism. The sensitive element is a metal bulb

"solid filled" with liquid, connected to a single diaphragm for direct transmission of movement to the switch. Designed with high load carrying capacity of 25 amperes at 120 volts, 15 amperes at 240 volts, a.c. and d.c. Cover range from 20-500 deg. F.

The fan or warm air limit switch, the application illustrated, has an adjustable differential. Is available in simple or combined forms, including two speed types for either 3- or 5-lead motors. Julien P. Friez & Sons, Baltimore, Md.

Lighting Unit

Ivanhoe RLM silvered bowl diffuser for use with 300- and 500-watt silvered-bowl Mazda lamps. Made of 22-gage steel. The inner reflecting surface and the outside surface are coated with white porcelain enamel. Aluminum insert fixed in inside top of reflector is of 18-gage No. 2 reflector sheet aluminum with semi-specular surface finished by the Alzak process. Angle of the reflector side is designed to provide protection from direct and reflected glare. Comes with standard conduit mounting top as well as with disconnecting holders which make it possible to take down and put up reflectors without disturbing present wiring connections. The Miller Co., Meriden, Conn.



Electric Hoist

"The Cable King" electric hoist provides air cooling for the load brake and main gear assembly. The gears and load brake are totally inclosed, and are air-cooled by air sucked in and pressure-circulated over and around the housing. Gear train and load-brake mechanism operate in bath of oil. Available in capacities from ¼ to 6 tons, all commercial voltages and frequencies. Variable speed hoists available for a.c. and d.c. For use on hook or lug, plain or hand-geared eye-beam trolley, and motor trolley suspensions, special monorail systems, and winch-type floor mounting. The Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia.

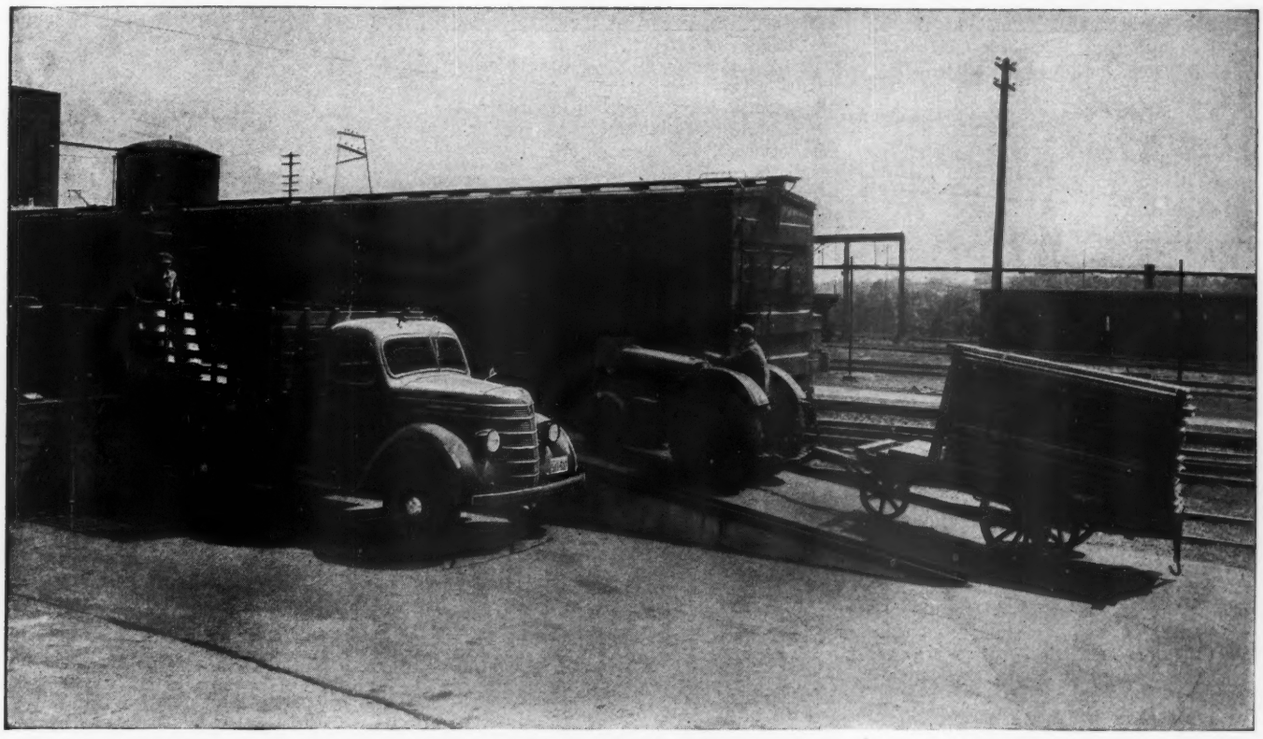
Welder

Model E a.c. welder has range of 20 to 280 amp. and takes any a.c. welding electrode from $\frac{1}{16}$ to $\frac{1}{4}$ in. Has single-dial control and is easily portable. Operates on any standard 110- or 220-volt circuit and may be quickly changed for operation on either voltage by simply changing position of a copper bar. Dimensions: 20x13x23 in.; portable. Hampton Electric Tool Co., 700 Walnut St., Edgewood, Pittsburgh.

Bin

"Add-A-Bin," a system of unit bins sold separately and assembled by user to fit his needs are designed for keeping

Take Stock of Your Materials-Handling Problems . . . Then Call in International



The Stores Department of the Pere Marquette at Grand Rapids, Mich., depends on the compact, efficient International Model I-12 Industrial Tractor to speed the moving of materials. This department also uses the International 1½-ton Model D-30 Truck shown here.

You owe it to yourself and your business to investigate International Industrial Tractors and International-powered equipment for your materials-handling jobs. International *design, quality construction, performance, economy,* and *after-sale service* are everything you want for your operations. The wide acceptance of International Tractors throughout every industry is the best assurance of their ability to solve your problems.

International Industrial Tractors are available in wheel and crawler types for gasoline and Diesel operation. International Power Units are available in eleven models, ranging up to 110 max. h.p., for gasoline, gas, and Diesel operation. International Modified Units are supplied to equipment manufacturers only, and always sold as integral parts of high-grade equipment.

Find out what International can do for you. Ask the nearby International industrial power dealer or Company-owned branch for complete information.

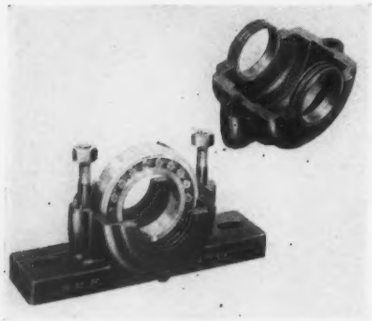
INTERNATIONAL HARVESTER COMPANY
(INCORPORATED)
180 North Michigan Avenue, Chicago, Illinois

INTERNATIONAL Industrial Power

track of screws, bolts, nuts, washers, rivets, fuses, and other small parts. Bin housing may be screwed to a wall, bench, cupboard, or panel as a portable kit. Closes automatically, but may be locked open or removed entirely from housing. Made in two series: 3-in. and 4-in. with varying capacities. Welded construction. Noggle Products Co., Ann Arbor, Mich.

Bearing Seal

Triple seal made for complete range of standard shaft sizes, designed for split housings machined to allow axial



freedom of bearing. Consists of two split piston rings on each side of the housing, grooved on outside diameter to form a labyrinth seal with the two end bores of the housing. Inner rings serve as internal flingers. Inner and outer rings are mounted with splits 180 deg. apart to prevent leakage through the splits. To maintain close clearances between rings and housing, rings are not securely fastened to shaft, thus allowing seals to locate themselves axially whenever shaft expansion occurs. SKF Industries, Inc., Front St. & Erie Ave., Philadelphia.

Grease Lubricating System

The Model H Lubricating System for cranes and auxiliary equipment, holds 8 lb. of grease. Can be hand or pump filled. Has double-acting pistons to reduce time cycle of operation.

The system operates on the single line principle. The valves may be made up in blocks of four, each valve acting independently in parallel. Each has an indicator showing grease discharge, and each is adjustable as to quantity of grease to be discharged, each being capable of feeding up to 0.4 oz. per shot. Blaw-Knox Co., 2031 Farmers Bank Bldg., Pittsburgh.

Unit Heater

Model C "Breezo-Fin" unit heater has a one-piece, seamless, copper-tube heat element, with square, copper fins, spaced to give maximum radiation. Rubber silencers on motor feet keep motor vibrations inaudible. Has die-shaped, riveted fan of heavy steel construction, and pressed steel, adjustable louvers. Motor: constant-speed, single-phase, three-phase; or direct current. Two-speed motors for single-phase and direct current are also available. Five sizes ranging from 12 in. to 24 in. Buffalo Forge Co., Buffalo, N. Y.

Lamp

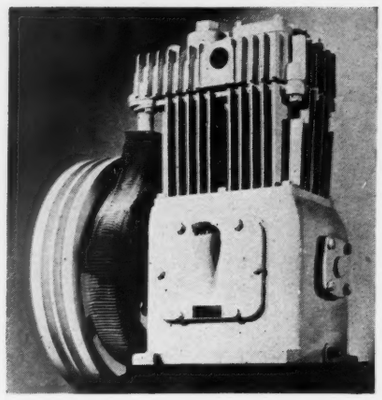
New type of lamp which comes in two models has a reflector inside the bulb. Is made with a flared bulb coated on the inside with metal. The metal takes a high polish and directs light of the filament in a powerful beam. Rated 150 watts and available for 110-, 115- and 120-volt circuits. "Projector Lamp" is in a bulb of parabolic shape made of heat-resisting glass. It is available with two beam widths, the first a narrow powerful beam which is known as the "Projector Spot Lamp," and the second a wide beam, which is known as the "Projector Flood Lamp." The second type is called the "Reflector Lamp." It has a narrow, powerful beam designed for spotlighting applications. It is made of soft glass so cannot be used out of doors. Westinghouse Lamp Division, Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

A.C. Welders

To reduce inductive losses, G-R Model 20 has close-coupled transformer design with die-stamped continuous core plates. Arc ignition in all heat ranges said to be instantaneous. Heat control, by wheel at top of unit, gives "stepless" current regulation. Has a direct-reading amperage indicator. A safety margin in coil and core materials provides safe operating temperatures. Wide range of rod types including many alloy and hard-facing rods may be used. Specifications: Single phase, 50-60 cycles, ampere range 15-160, open circuit volts 70, welding voltage 20-30. Glenn-Roberts Co., Inc., 1009 Fruitvale Ave., Oakland, Calif.

Colloidal Graphite

"Dag" colloidal graphite is now available in several grades distinguished primarily by range of particle size. The first, or top grade, will contain particles ranging between one micron and the submicroscopic. The particle size in this product is so minute that it may be said to border on true solution. With finer particles, the graphite can be used in a wider range of vehicles, and can be used to impregnate porous bodies and impart to them qualities of lubricity, electrical conductivity, and coloring. Acheson Colloids Corp., Port Huron, Mich.



Air Compressors

Mechanical refinements of a line of nine air compressors are: Simplified construction; 12 per cent greater radiation area on cylinders; more thorough and more positive constant-level oiling system; totally enclosed, dustproof crank cases; and non-breakable cushioned discharge valves. When furnished for automatic start and stop operation, they are equipped with a loadless starting device which automatically withholds all load from motor until it reaches full speed, thus eliminating need for check valves. Sizes: 2.8-30.1 cu. ft. per min. piston displacement. Single-stage, single-cylinder; single-stage, duplex cylinders; and two-stage models, are available in standard and special mountings. Quincy Compressor Co., Quincy, Ill.

Hand Lift Truck

Constructed to pick up and transport carboys, the truck has a lifting frame that straddles the carboy while its wing attachments on top permit adjustment

to take care of small variations in carboy widths. Has 6-in. mechanical lift. The load may be raised from either side or from front. To insure smooth lowering, an automotive type release check has been installed in each lower side frame. Roller-bearing wheels are semi-steel operating on alloy steel axles. The Yale & Towne Mfg. Co., 4530 Tacony St., Philadelphia.

5 YEARS WITHOUT CHANGING OIL
SAYS UTILITY SUPERINTENDENT
"... WE HAVE used the present batch of oil in our 5000 KW unit continuously for about five years.
"We have experienced no bearing losses, wiped bearings or electrolytic troubles in the bearings."
Five years is only the beginning of the trouble-free, money-saving service this superintendent will get with Nonpareil, because it's GUARANTEED for the LIFE of his turbine.
This superintendent also writes: "We have received valuable information from your Lubrication Engineers as a result of their visits to the plant and I wish to express my appreciation for this service."
Find out what this guaranteed turbine oil and Standard Lubrication Engineering Service can do toward reducing your turbine operating costs.
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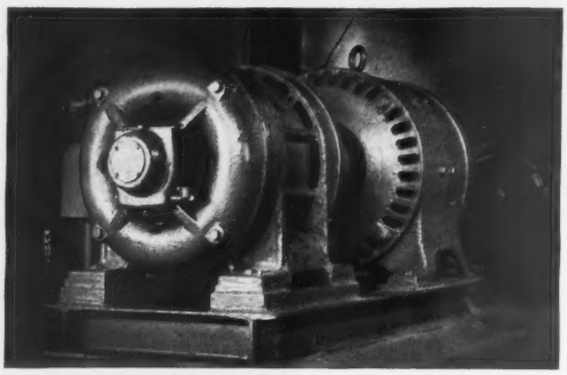
THE RIGHT LUBRICANT PROPERLY APPLIED

Reduces Costs for These Manufacturers



STANOIL

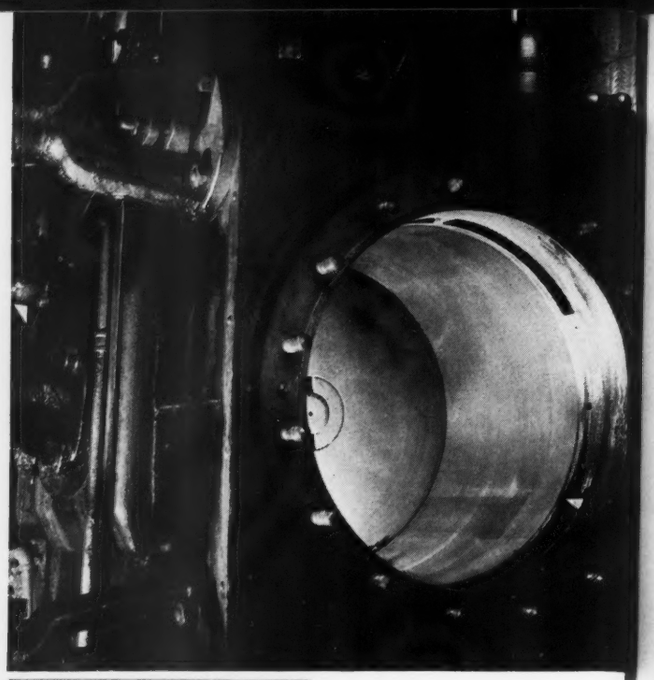
A motor generator set was burning out bearings because of sudden weather changes, even though summer and winter oils were used. The chief electrician found that one grade of Stanoil used the year 'round stopped weather guessing, ended bearing troubles.

SUPERLA GREASE

A conveyor manufacturer thoroughly tested several brands of grease before entrusting the roll bearings to the protection of Superla Grease. The higher viscosity oils in Superla and its freedom from separation even after long periods of service were some of the deciding factors in favor of Superla.

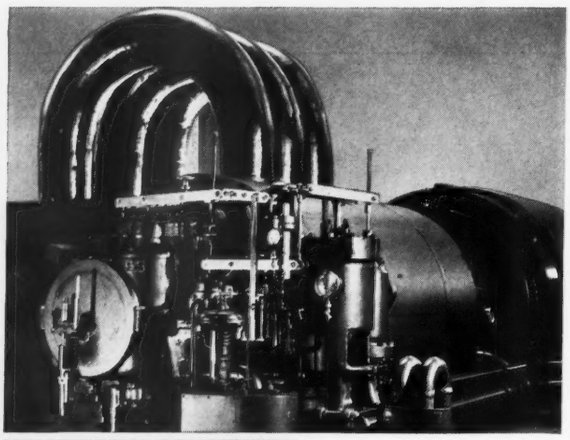
NEW **DEVELOPMENT IN LUBRICATION**

A booklet describing the latest development in lubrication is just off the press. A development that enables you to use one brand of oil to replace up to 27 specialized brands now in use *and do a better lubricating job.* Find out what this new idea might mean to you in reduced lubricating and maintenance costs. Ask for the booklet "Spare the Time to Spare Your Machine." Write Standard Oil Company (Indiana) 910 South Michigan Avenue, Chicago, Illinois.



STANOCYL

The superintendent of an industrial power plant could not get his Corliss engine to pull its rated load. Examining the cylinder he found it scored and dry although ample oil had been fed to the engine. A Standard Lubrication Engineer recommended StanoCyl W, an oil for use under wet steam conditions. Now the engine pulls a full load and there's no more scoring.

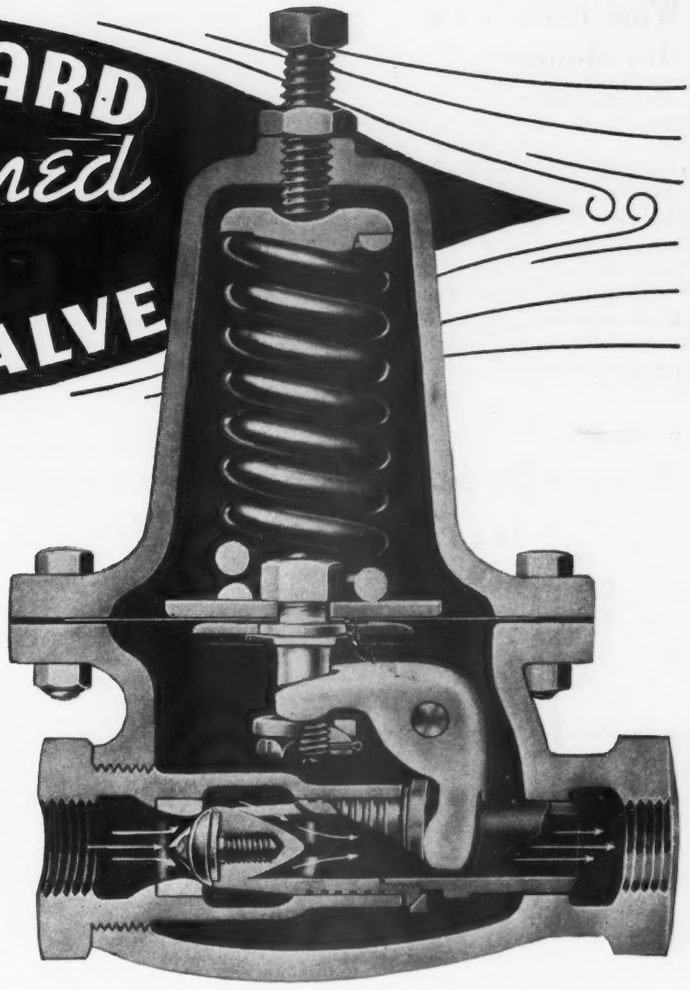


NONPAREIL TURBINE OIL

Governor driving gears on a turbine in a southern public service company power plant were being replaced every 6 to 8 months. In an attempt to overcome the difficulty Nonpareil Turbine Oil was installed. That was 6 years ago. A recent inspection showed this 6-year-old set of gears to be in perfect condition. The same fill of turbine oil is still in use.

Standard Lubrication Engineers are located in 29 offices throughout the middle west. There is one near your plant ready to help you with any lubrication problem and to help you get more for your lubrication dollar. This service is free if your plant is in any of the 13 states shown above. Write Standard Oil Company (Indiana) 910 S. Michigan Ave., Chicago, Ill. for the Engineer nearest you.

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVE



Straight Line Flow . . . .

ASSURES GREATER CAPACITY... TIGHT CLOSURE . . . CLOSER DELIVERY PRESSURE CONTROL

Steam, Air, and Water Capacity Charts

Send for copy of Bulletin No. 1000—it contains handy capacity charts for Steam, Air and Water, as well as a completely illustrated description of the streamlined action of the new Cash Standard Type 1000 Pressure Reducing Valve.

IN THE illustration above, note how the Streamlined contour of this valve assures the unusual efficiency provided by the straight-line flow of Air, Steam, Water, Oil and other Liquids and Gases through the valve.

Note particularly the ideal venturi approach to the valve opening — the very slight bending of the flow around the streamlined form — through the large valve ports—the absolute straight-line flow through the jet of the outlet pipe. . . . Because of the streamlined design the fluid flow is not detoured around a dividing wall—turbulence and back eddies which check the liquid flow are eliminated.

Use this valve wherever it is necessary to obtain accurate pressure reduction in the flow of hot or cold liquids or gases. . . . Handles inlet pressures up to 3000 lbs. . . . Made in 8 high-pressure and 8 low-pressure sizes.

A. W. CASH COMPANY
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CASH STANDARD CONTROLS . . VALVES

What Greases for Hot Motors?

(*Continued from page 84*)

leaks through this shield noticeably at some temperature, it is an indication that the grease cannot satisfactorily be used in a motor at that temperature.

The running-torque readings on the B.E.C. machine give a rough indication of when the danger point on thinning relative to grease retention is reached. Experience has shown that if the running torque at any temperature never goes below 180 gram-centimeters, the chance of grease leakage is small. There are always exceptions to the rule, however, in that some thin greases have been found which stay in place better in sealed bearings than do others of heavier consistency. An effect of capillary action may be involved.

An indication of this effect may be obtained by polishing some strips of stainless steel about 6 in. long by 1 in. wide, marking a line across them 2 in. from one end and smearing a standard weight of grease to a thickness of $\frac{1}{16}$ in. over the 2-in. area. The strips are then allowed to remain at normal temperature and observed every few days for the extent of oil creepage along the polished surface. The oil from some greases will creep five or six times as fast as that from others.

Instead of a grease thinning out under high temperatures, the opposite effect may be noticeable not only in bearings on preliminary test in ovens but also in motors under operating conditions. That is, there may be a change in the physical structure which causes hardening with age, independent of the stiffening due to oxidation of the grease. This action is especially characteristic of sodium- and sodium-calcium-base greases. When the grease is first put in a motor it operates satisfactorily, but as time goes on it stiffens. If the bearing cap is removed and the grease examined, it appears to be in perfect condition in the cap, whereas in reality it has hardened sufficiently so that none is being fed into the bearing, which eventually fails from lack of lubrication. This condition is especially undesirable with roller bearings, which require a grease thin enough to get in around the ends of the rollers at all times or excessive wear will result.

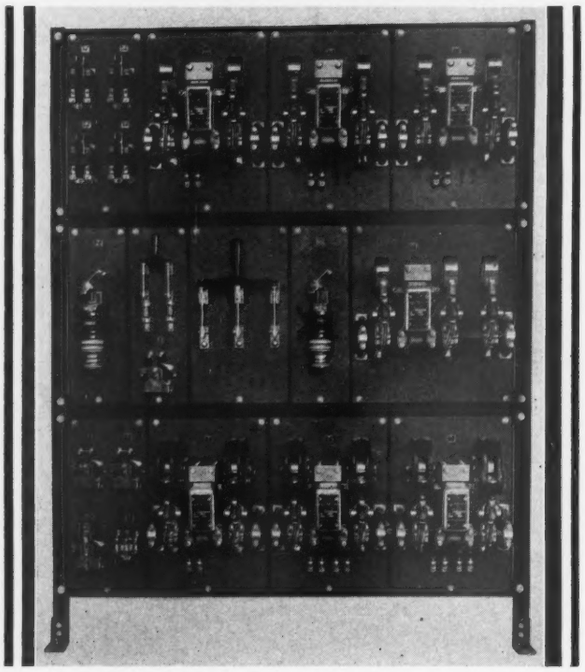
Watch the Fibers

There is also some temperature beyond which these sodium- and sodium-calcium-base greases cannot be heated under rotation without fiber growth taking place. Most sodium-base greases when manufactured have a structure composed of long fibers and are commonly referred to as fiber greases. Because a smooth, butter-like consistency is desired by most users, this fibrous structure is broken up and the fibers shortened by milling the grease. Such treatment gives the smooth appearance desired at normal temperatures, but if the grease is heated and churned at a certain temperature, which will vary with the percentage of soap present and the method of manufacture, the undesirable, long-fibered structure may return. These long fibers roll into balls and prevent successful lubrication; hence this is another feature to watch out for.

If all the conditions mentioned are met, the grease is then ready to be tried out in a motor equipped with bearings having bronze retainers and running at the desired temperature. After passing this final test the grease is considered to be satisfactory.

To be entirely satisfactory for operation at 300 deg. F. a grease should

Hyper-Synchronous Lowering Speeds for A. C. Crane Hoists



EC&M Frequency Relay Magnetic Control with counter-torque lowering is a new control which not only increases crane-handling-ability by faster lowering speeds but in addition, provides a much greater degree of controlability on all counter-torque lowering points. In the past, A. C. hoists have been limited to approximately synchronous motor speed in the lowering direction, but with this new EC&M Control, hyper-synchronous speed (50% faster) is now possible. Inching operations in the down direction are also improved with this control.

THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.

THE ELECTRIC CONTROLLER & MFG. CO.
2688-S E. 79th St., Cleveland, Ohio

Gentlemen:

Please send me further information on the EC&M Frequency Relay Magnetic Control with Counter-torque Lowering for a .....HP .....Volt .....phase .....cycle A. C. Wound Rotor Motor.

Name.....

Company.....

Address.....

FIRST STEP IN LIGHT CONDITIONING YOUR PLANT

Ceilings and Walls *painted* with Light-reflecting *Save-Lite* . . .

Better light, better sight...better work, fewer errors, lower production costs—that's an axiom in modern plant management. And the first step to better light...perfect light conditioning...is ceilings and walls painted with lustingly white Sherwin-Williams Save-lite.

Whatever your work...however you do it...you'll find a Save-lite specially formulated to stand up, keep its high light reflecting whiteness under the most "difficult" conditions prevailing in your plant. Let the Sherwin-Williams painting engineer make a survey of your buildings. He'll tell you exactly which kind of Save-lite you need and where you need it. No obligation. Or write for the Sherwin-Williams "Plant Conditioning Report". It is free. Address The Sherwin-Williams Company, Cleveland, Ohio and all principal cities.

COVER THE EARTH

SHERWIN-WILLIAMS SAVE-LITE

THE PLANT CONDITIONING PAINT

possess the following characteristics: (1) It must not oxidize and turn acid, burn, or get sticky. (2) There must be no separation of oil and soap, and it must not dry out. (3) The grease should not become stiff or hard in the presence of any metals with which it may come in contact in a bearing. (4) It should be of smooth, buttery consistency and remain that way in the presence of heat, without becoming fibrous. (5) Since darkening of color is tied up intimately with the first stages of oxidation, the grease should not darken at the temperature at which it is to be used.

The heavy, steam cylinder oil type of grease may prove most satisfactory if running torque and ability to lubricate at a low temperature are not factors.

At present the number of greases which will pass the majority of these tests is very few. None that I know of will pass all of them, but progress is being made. Grease manufacturers have done intensive work during the past two years to develop better products, and as a result the standards of lubricating greases are much higher than they used to be. There is still some feeling that to say a grease must stand 300 deg. F. is asking the impossible. This requirement can be met successfully at the present time if the grease does not come in contact with certain metals which act as catalysts to promote oxidation. Possibly the time is not far distant when this last obstacle will be overcome, and the ideal grease will be available.

Like to Cut Power Bills?

(*Continued from page* 82)

sary. An automatic demand control (Figure 4) which I designed and installed was described in the April, 1937, issue.

Alternatively, the output of an auxiliary generator connected to the system may be controlled for the same purpose. It is essential that an automatic demand control be designed to operate on exactly the same principle that demand is measured.

3. To reduce or eliminate the penalty for poor power factor or excessive kva. demand:

(a) Use motors with high power factor. Synchronous motors are usually to be preferred for large, slow-speed drives.

(b) Avoid use of transformers that require a high exciting current. This feature is characteristic of some of the older designs.

(c) Eliminate lightly loaded induction motors and transformers as far as possible.

(d) Employ power factor corrective equipment such as:

1. A synchronous condenser, which is an over-excited synchronous motor running light on the line. When designed for the purpose a synchronous motor will carry a mechanical load and correct power factor at the same time. Use of such motors is usually the most economical method of correcting power factor in medium- and large-sized plants.

2. Static condensers. These devices have no moving parts, and operate with negligible losses. They may be distributed throughout the plant and located close to the motors causing poor power factor. Industion motors with built-in static condensers are available. Static condensers are well suited to small plants.

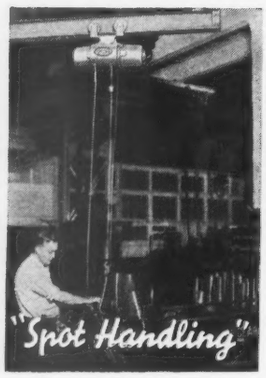
3. Phase advancer. This is a special type of generator which excites the rotor of a slipring induction motor with low frequency alternating current, in much the same manner as the field of a synchronous motor is excited with direct current. Usually a phase advancer corrects only the

I SAVE MY STRENGTH FOR MY REAL JOB

"My boss realizes that muscle power is the most expensive power there is. I just press buttons to get work on and off the chuck. I get more done with less effort . . . and it's costing the company less. That's why the other boys are getting Zip-Lifts, too."

HOW THE ZIP-LIFT FREES SKILLED HANDS SAVES TIME AND MONEY

That's the way it always goes! Once you try a Zip-Lift, you'll find that it quickly pays for itself with faster, more accurate handling of heavy pieces on and off machine tools. It's easy to install; just hang it on a hook, jib or trolley and plug it in. Frequently, one Zip-Lift can serve two or three machines. Why not get cost figures on actual case studies? . . . see how much you can save? The coupon makes it easy.



The ZIP-LIFT stops waste with "Spot Handling"

WANT THE WHOLE STORY? SEND THIS:

HARNISCHFEGER CORPORATION

HOISTS • WELDING ELECTRODES • MOTORS P&H EXCAVATORS • ELECTRIC CRANES • ARC WELDERS

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4525 W. National Avenue,
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Send copy of Bulletin H-2, "Handling Costs Are on the Spot."

Firm Name .....

By..... Title.....

Address .....

City..... State.....

Way back in the '80's..... wasted H. P. meant this to business management.

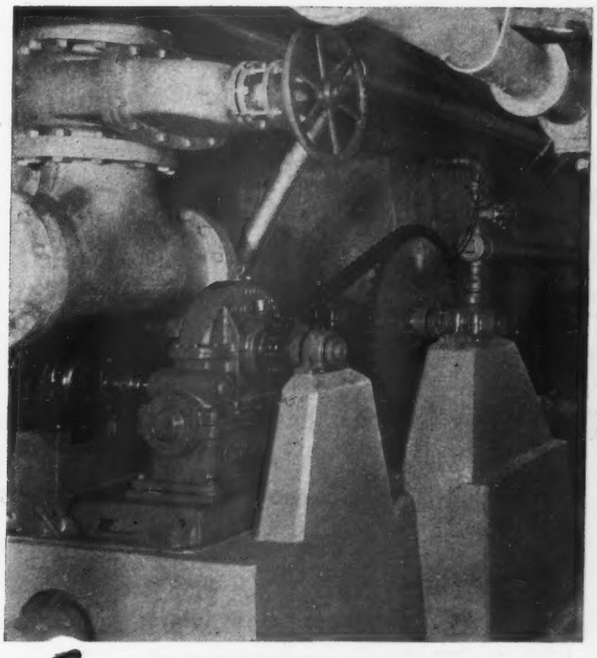
. . . . . but, TODAY if you are wasting horsepower, *through inefficient Power Transmission Devices*, it means YOU NEED PHILADELPHIA WORM GEAR SPEED REDUCERS

By concentrating on correct design and accurate manufacture of the worm and worm gear sets that go into Philadelphia Worm Gear Reducers, we have developed units having the highest possible efficiencies. On actual production they transmit power, with efficiencies that average up to 95%. To procure this, and still maintain a heavy load carrying capacity, the gear sets have been designed to operate with maximum rolling action and minimum sliding action.

Every detail of manufacture has been carefully watched, beginning with the materials which are generally chill cast nickel-bronze for the gear and a high alloy steel worm carefully carburized to give proper depth and hardness of case.

The ultimate in precision and accuracy is accomplished by the final machine grinding of the worm threads and accurate generation of the gear teeth. This positively insures correct tooth form and a smooth bearing surface.

For full information about these units send for our catalog No. 24.



The modern drive at the right shows a Philadelphia double reduction Worm Unit operating water treating equipment. Note the heavy overhung load.

PHILADELPHIA

WORM GEAR

Speed Reducers

PHILADELPHIA GEAR WORKS

Industrial Gears and Speed Reducers

ERIE AVENUE AND G STREET, PHILADELPHIA, PA.

power factor of the motor to which it is connected.

When operating power factor corrective equipment, or considering its installation, make sure that the most beneficial results are obtained under the terms of the power contract and with the billing meters used. Do not go to the expense of correcting power factor or reducing kva. demand more than necessary, or when not required. Power factor may be controlled automatically to advantage.

Since each plant is an individual problem it is possible to deal here only in generalities. The chances are good, however, that a thorough investigation of the electric power problem in almost any plant will well repay the effort spent on it.

Going "Straight Line"?

(Continued from page 69)

be able to do a particular job and do it with a certain precision, even though one job is harder than another, just as the backfield players have a bigger job than the men on the line, yet each man must do his part.

The straight production line must be flexible, because consumers will not all wear the same type of garment. Even though the garment be an overall, some want it one way and some another. And next season the styles change. Automobile manufacturers spend millions of dollars each year for new dies to change the looks of the new models, but they continue to use the same punch presses. A few dollars should suffice to change a "straight line" to accommodate new styles.

A wage-payment plan should be worked out so that the operators will share in the savings according to their efforts. Additional spirit and enthusiasm can be obtained by weekly meetings of department heads and operators' representatives, either picked or elected, to discuss methods of improving anything and everything, as well as to air grievances. A small grievance that is ignored grows and multiplies faster than a flock of rabbits. Employer-employee relations must be kept right.

The "straight line" is here to stay for garment manufacture just as surely as it will stay for automobile assembly. The only wonder is that the garment companies did not all take it up 20 or 30 years ago.

Let us not only realize that there are no mysteries to straight-line production, but also that it takes technical knowledge to set up such a line, plus a lot of experience and good common sense.

Built-in COMPACT Lubrication
The correct oil film to each individual bearing... automatically
"International" Simplex E-7 Motion Picture Projector
BIJUR
AUTOMATICALLY Correct LUBRICATION
• Whether 2 or 100 bearings are to be lubricated, BIJUR lubrication pays. Pays in lower maintenance costs . . . higher machine efficiency . . . fewer interruptions in schedule . . . cleanliness . . . freedom from lubrication worries. Compact, built-in Bijur equipment (centralized, forced-feed) for machines of all types and sizes. Automatically meters clean oil-film to every bearing . . . none forgotten.
Write us about your lubrication problem.
BIJUR LUBRICATING CORPORATION • LONG ISLAND CITY, NEW YORK
1075

Six Checks on V-Belt Drives

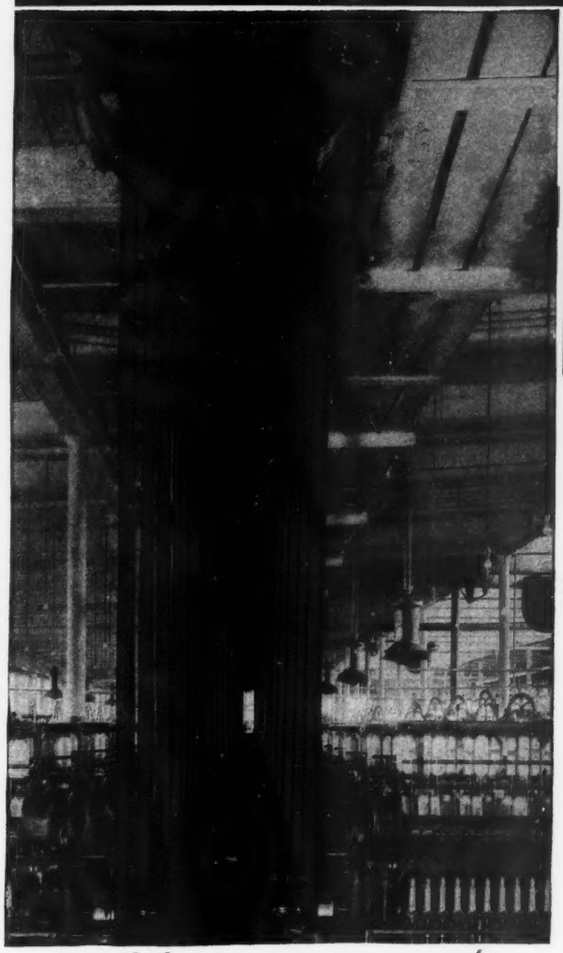
(Continued from page 76)

of the load. It is not always essential that a so-called matched set be furnished to accomplish this purpose. The V-belt manufacturers restrict their production to reasonable tolerance limits, and then divide the belts into groups. Some of these groups are distinguished by letters and others by numbers. For general practical purposes it is satisfactory to obtain a set of belts that are known to come from the same length grouping.

Much of the trouble that has been blamed on lack of matching can better be attributed to improper breaking in. After new belts have been applied, they should be carefully watched for several days and taken up as necessary to insure even running and correct tension. Almost invariably, the result of this careful attention is a well-matched, smoothly operating set of belts.

Matched sets are helpful on certain

Equalized Ply Stresses Mean Economical Drives



Condor Compensated on a bicycle drive in a textile mill.

Condor Compensated BELT
PATENTED
TRADE MARK REGISTERED

REDUCES

PLY RUPTURE
PLY SEPARATION
PULLEY-SIDE WEAR

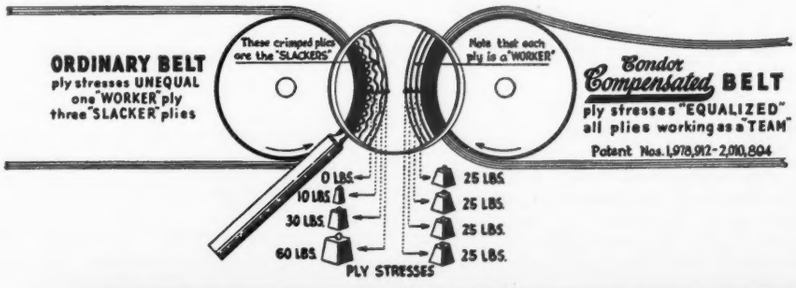
Condor Compensated—like any other belt—does most of its work under tension as it flexes around the pulley. ***But unlike any other belt,*** it is relieved of the destructive effects of uneven stresses and strains—because each ply is compensated to equalize each ply's load.

The important benefits to you in this patented and exclusive construction is that ply ruptures and ply separation are eliminated . . . and there's less wear on the pulley side. Nine other advantages help contribute to Condor Compensated's efficient and economical transmission of power.

Condor Compensated can be operated at *low tension* because of a special pulley-side surface, and is also available in Type F where rubber friction surface is desired, and in Type B where some slip is necessary.

12 ADVANTAGES

1. Ruptures in outside ply eliminated.
2. Freedom from ply separation.
3. Longer fastener life.
4. Can be operated on smaller pulleys.
5. Less bearing, shafting and hanger troubles.
6. For heavy loads, plies may be increased with same pulleys.
7. Operation less affected by atmospheric conditions.
8. Higher overload capacity or margin of safety.
9. Less wear on pulley side.
10. Can be dressed without injury to belt.
11. High production efficiency.
12. Material reduction in belting costs.



THE COMPENSATED PRINCIPLE

Notice in the diagram at left each ply shares its part of the load as the belt flexes around the pulley—where the destructive work is done. Write for your copy of Bulletin 6808C—it explains the Compensated Principle in detail.

THE MANHATTAN RUBBER MFG. DIVISION
OF RAYBESTOS-MANHATTAN, INC.
EXECUTIVE OFFICES AND FACTORIES, 33 TOWNSEND ST., PASSAIC, N. J.

types of drives, and should be applied when needed. Generally speaking, they should be used on drives having inherent features that tend to produce vibration; on drives whose center distance must be longer than nominally recommended; where it is impossible to use enough belts for the required power; and on pulsating loads.

Flat-Pulley Drives

No discussion of change-over design problems would be complete without some mention of V-belts used on flat pulleys. It is frequently desired to utilize a flat pulley on the driven end of a machine. Within practical limits this type of drive is satisfactory, but it must be recognized that it presents pitfalls that should be avoided. For example, in choosing the driving sheave, you are working from a given diameter of the existing driven pulley, and when it is divided by the speed ratio, the driving-sheave diameter may fall below the recommended pitch diameter for the belt cross-section necessary to carry the load.

Again, the face of the flat pulley may not be sufficiently wide to accommodate all the belts that are necessary to handle the load properly. However, it is a recognized fact that drives of this type, when properly designed, are satisfactory, and in many instances a saving can be effected by the use of an existing flat pulley.

There are installations in which V-belt drives run on crowned flat pulleys, but it is considered good practice to remove the crown. If it is necessary to use a flat pulley with a crown, it is generally good practice to use an even number of belts and not try to run a centrally located belt directly over the crown.

Engineering data books covering all these matters more in detail can be obtained from any sheave or belt manufacturer. For the most part, satisfactory drives can be designed from these data books, but whenever the problem becomes involved, or presents unusual conditions, it is advisable to get advice from a representative of one of the manufacturers.

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RYERSON *Certified* STEELS

Motor Trouble?

(*Continued from page 73*)

a chain is too loose, whipping will result.

These points should be checked with the chain manufacturer, who should also be consulted for lubrication recommendations.

Multiple V-belts are now so commonly used for short-center drives that little need be said concerning them, or the V-flat drive, except to warn against having the belts too tight or too loose. The first condition results in shortening belt life and overloading the bearings, with loss of power. The second condition leads to excessive wall wear. It is always accompanied by the squeaking noise characteristic of slipping belts and should be attended to as soon as possible.

Shafts Must Be Parallel

The same precautions outlined previously for chain drives apply with equal force to V-belt drives, in that the shafts must be parallel and the grooves in line.

Flat belts are used so widely in many plants that no one ever stops to think that drives might be the better for some attention. It is never amiss to repeat the old rules that tight belts should be avoided, and that the under side of the belt should be the tight side. Where tight and loose pulleys are used with a wide motor pulley to allow for the required belt movement,

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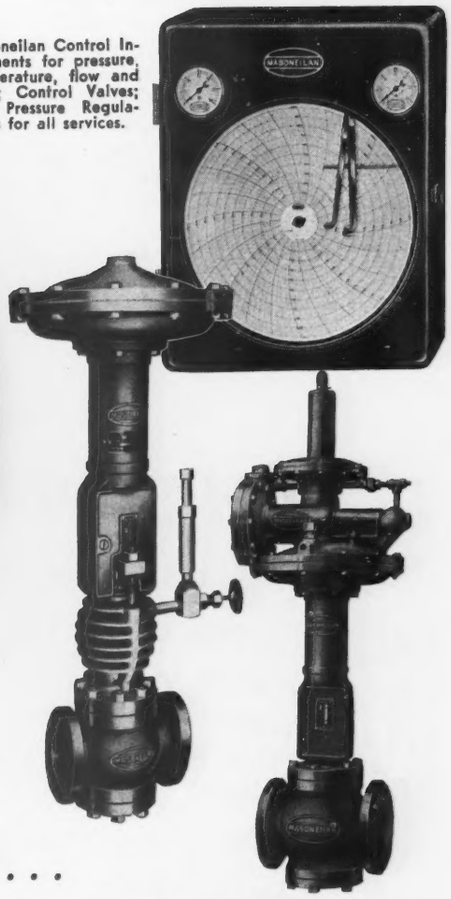
- Centralize Production Control Where Delays and Waste Can Not Pass Unnoticed



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Control Production and Costs

According to Mr. Leslie Soule, Factory Manager, Mason-Neilan Regulator Co., Boston, Massachusetts, their McCaskey Controls do a complete production scheduling, follow up, and cost job for them. Read what he says:—

"Manufacturing a quality line of industrial instruments, control valves and regulators to sell against stiff competition necessitates holding down processing costs.

"McCaskey Controls enable us intelligently to schedule machine operations and delivery of raw materials and to follow up each operation on hundreds of production orders from a centralized control point. The exact status of any order of the hundreds in process may be determined at a glance without the necessity of employing production chasers.

"Accurate costs are obtained with very little clerical work through the use of multiple copies of time and material tickets. Cost data are almost immediately available, not only when the job is completed but at any time during operation. The system gives us a much closer control of shop orders and enables us to make reliable promises to customers and keep them."

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We cannot suggest exactly how McCaskey can help *you* until you have talked with a qualified McCaskey representative . . . No obligation . . . He will show you how McCaskey methods may be adapted to meet *your* requirements . . . Or, may we send you descriptive pamphlets? .

●

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the belt should be closer to the motor bearing when driving on the tight pulley.

Lineshaft bearings must never be allowed to become excessively worn or loose, because the whipping of the lineshaft sets up vibration that is transmitted to the motor and may result in bearing failure.

When a Shaft Breaks

Broken motor shafts are not of frequent occurrence but when one develops a thorough investigation should be made to determine the reason, or a recurrence is almost inevitable. With flat-belt or V-belt drives the cause may be an unbalanced pulley or sheave; a loosely-fitting pulley, which causes fatigue of the shaft from the continual movement; or the load may be applied at a point on the shaft extension too far from the bearing. This latter fault is sometimes met when the motor is arranged to drive two separate loads by means of two belts, the outer belt overloading the shaft.

Shaft breakages are most frequent on geared drives where the gears have become badly worn, or some of the troubles already mentioned are experienced. If a standard motor is being used for some arduous application, as on rapidly reversing duty or other unusual service, and shaft breakage results, the new shaft should be made from a high-grade nickel or nickel-chrome steel.

In the event of breakage it is always advisable to obtain a new shaft from the motor manufacturer in order to make sure that the correct steel is obtained. However, if it is necessary in an emergency to make up a shaft, the machinist should be acquainted with the need for accuracy and care. Forbid the making of any sharp corners; allow only nicely rounded fillets to be made, particularly at the driving end, at the reduction to the bearing journal or seat, and at the shaft extension. This is a most important precaution; unless it is observed, a clean break at the sharp corner may be expected, even though the shaft there may be of somewhat greater diameter than nearer the load.

Keyways should be cut before taking the final finishing cut, so that any distortion of the shaft will be corrected. It is preferable to cut the keyway for the rotor core 180 degrees from the pulley keyway.

Periodic Inspections

Diameters of bearing seats for ball or roller bearings should be made exactly the same as on the old shaft. If they are only very slightly greater, the increased interference may cause premature bearing failure. On the other hand, if the bearing seat is undersize, the bearing race may work loose despite the holding nut, and excessive wear of the shaft inside the race will result.

Troubles mentioned in this article are not entirely commonplace, but this fact should cause plant engineers to pay close attention to the suitability and condition of drives throughout their plants. It is well to institute a periodic drive inspection because settling of foundations and various other causes may bring about improper conditions in a drive which was perfect when first installed. Careful, periodic inspection usually reveals some condition or other that will eventually result in trouble and costly repairs.

Those who make full use of drive data furnished by the various manufacturers, and who instruct their maintenance staff as to the importance of having all drives correctly installed and inspected, will find that the extra trouble taken will be amply repaid in improved motor operation and freedom from shutdowns, with their associated worry and expense.

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Chief Sign Co., winner of contest to find oldest Unishear, says of their "Mighty Midget": "It's our oldest employee. Used for many years cutting metal for truck bodies, now used in fabrication of electric sign boxes and faces. Handled carefully or carelessly, it has stood up twelve years with only the cost of a minor repair."

Stanley Unishears, portable and stationary, make records wherever sheet materials are cut. They do the job quicker, cleaner, easier and at lower cost. Ask for a demonstration, or write for literature. Stanley Electric Tool Division, The Stanley Works, 151 Elm Street, New Britain, Connecticut.

"Mighty Midget," capacity 18 gauge hot rolled steel. (Also No. 16, capacity 16 gauge hot rolled steel.

No. 144A Unishear, capacity 12 gauge hot rolled steel.

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For further information, see your nearest G-E Merchandise Distributor or write to Section CDW-9101, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

Industry's 1939 Program

(*Continued from page 58*)

characteristics of our American life, including all aspects of personal liberty.

Since 1930 the total volume of savings and credit invested in business has been only a fraction of that needed to provide capital facilities which could either maintain employment and living standards or increase them for an increasing population. The deficiency created has in large measure been caused by discouragement and impediments to new enterprise created by public policies and legislative enactments. *It is essential for sustained recovery that investment of savings in private enterprise be greatly increased and maintained.*

Though designed for the protection of investors through correction of abuses in the creation, issuance and subsequent trading in corporate securities, yet both the Securities Act of 1933 and the Securities Exchange Act of 1934 include provisions which are unnecessarily severe. Also the cost and time consuming requirements for compliance with the provisions of these statutes are greater than necessary for the protection of investors.

Since the enactment of these laws there can be little question but that they have had a substantial effect in holding down to the present subnormal level, the aggregate volume of new corporate securities issued and offered for sale to the public. While these enactments are burdensome upon all business it should be emphasized that they bear down with special weight upon small and marginal enterprises, the importance of which in our American economy needs no argument. Repressive provisions of these statutes should be moderated without impairment of their essential regulatory functions.

Job-making capital investments have been discouraged also in recent years by government policies which create fear of inflation. Such fear would be dispelled by—

Definite and dependable currency standards which permit industry to plan ahead;

Public debt levels not so high as to constitute a threat to currency stability, impose undue burdens on the taxpayer, or pile up excessive obligations for future generations to pay.

Immediate, genuine and determined steps toward a complete balancing of the national budget.

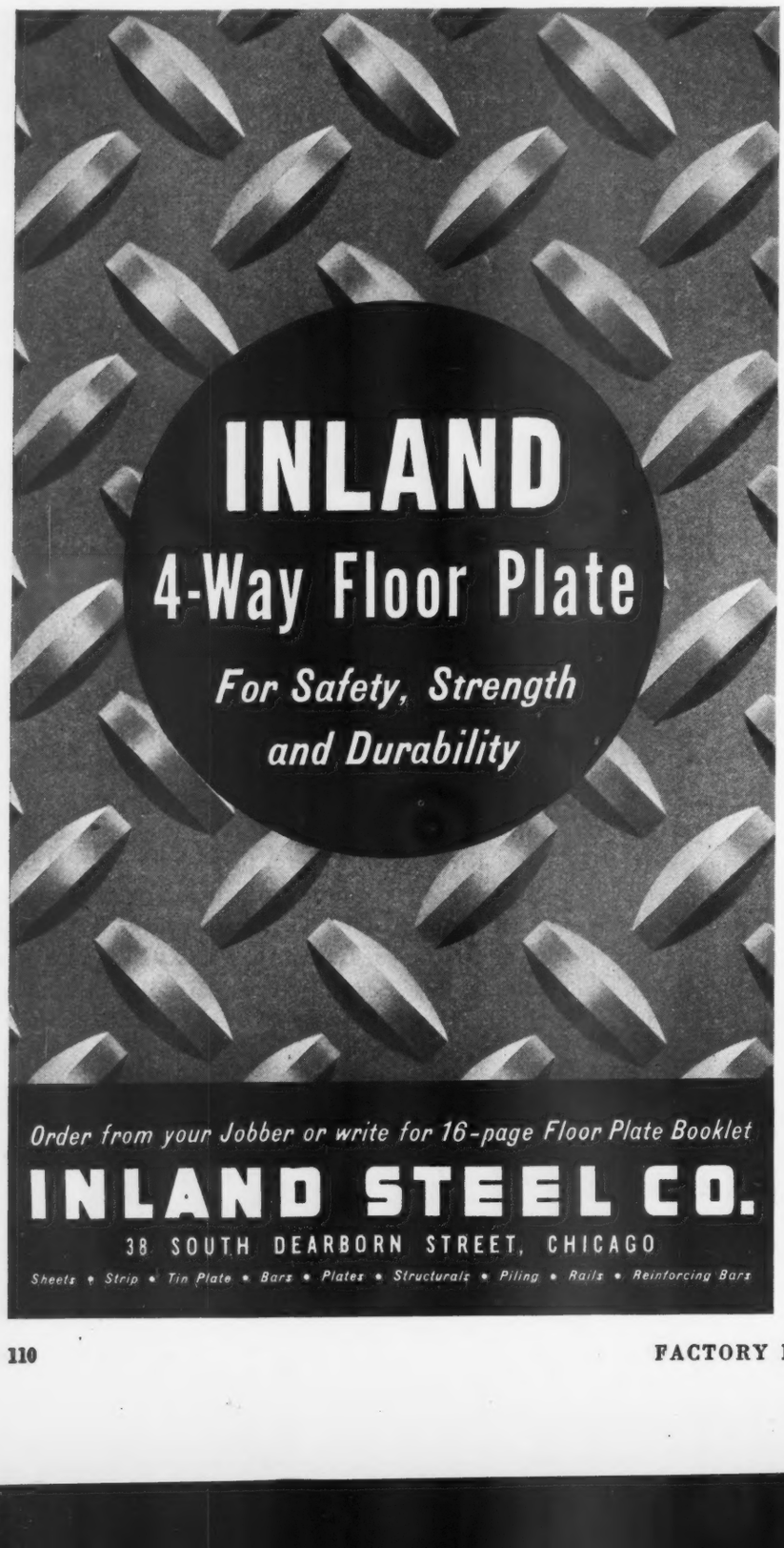
4. Purchasing Power

Purchasing power for the individual means the amount of goods and services he can buy with his money. The nation's problem is to increase purchasing power—particularly that of those who have the smallest amount of it—but the question is how to do it. We know that the greatest advance in living standards has occurred when production was constantly increasing. The lesson of history is that *purchasing power of the population is determined by the total volume of production and distribution of goods and services,* and that our future standard of living depends upon the volume of our future production.

Schemes to create purchasing power by artificial re-distribution of wealth do not increase production and consequently do not bring about increased employment. On the contrary, they drive capital into hiding, destroy the spirit of enterprise, and reduce the volume of employment. Producing more for constantly widening consumption is the only sound form of wealth distribution.

Attempts to manipulate the purchasing power of money without regard to the volume of production will not improve the standard of living.

Sound prosperity for farm and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TANNATE LEATHER BELTING
INCREASES YOUR OUTPUT AND PROFITS

"When We Put on a TANNATE Belt We Can Forget the Machine!"

declared a factory owner . . .

" . . . and they never give us trouble."

Other TANNATE users have sent us similar expressions. Such belt service means low maintenance costs, a steady running of factory units . . . and the all-important *lower production costs.*

A great many TANNATE users know that the unusual grip and flexibility of TANNATE Leather Belting give it a power-transmitting capacity seldom found in other belts. This reserve capacity takes care of your starting-, peak- and temporary over-loads with a degree of efficiency that brings you more profits through greater production.

Send us data TODAY regarding any drives for which you need belts now, or which are giving you trouble, and ask us to send TANNATE Belts to fit them. Every TANNATE Belt is backed by the famous Rhoads Service Guarantee

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factory can exist only when equitable price relationships bring about maximum exchange of their goods and services.

5. Regulation Versus Control

Regulation, for the public good, of certain aspects of private enterprise is recognized by all as an essential function of government.

Government should not, however, either operate or directly control the facilities of private business engaged in production or exchange of goods and services. Regulation and control are inherently different. Regulation functions from the outside, fixes in advance the rules of conduct, and should deal impartially with all. Control penetrates into the interior and becomes a part of managerial authority. When government control enters, the effectiveness of private management is impaired if not destroyed.

Regulation of manufacturing enterprise should be confined to insuring freedom of fair and open competition, together with protection of the rights of others, whether competitors, employees, employers, consumers, or the public.

Wherever regulation of manufacturing enterprise is imposed by government it should be embodied in specific statutes and administered, insofar as is possible, by the established executive departments of government.

Any necessary special agencies should be given a minimum of administrative latitude and should be required to exercise administrative discretion by the issuance and advance publication of specific regulations, with opportunity for public hearings thereon.

Regulations issued by such special agencies, and the administrative rulings of both executive departments and special agencies, should be subject to adequate judicial review of the law and the facts by the established judicial departments of the government.

Government should not attempt by compulsion or inducement to control the kind or quantity of goods and services to be produced and distributed to the people, beyond measures required to insure fair, free, and open competition and to protect the public health. Any such control will lead inevitably to the destruction of private enterprise and the rise of some form of state controlled enterprise.

6. Taxes

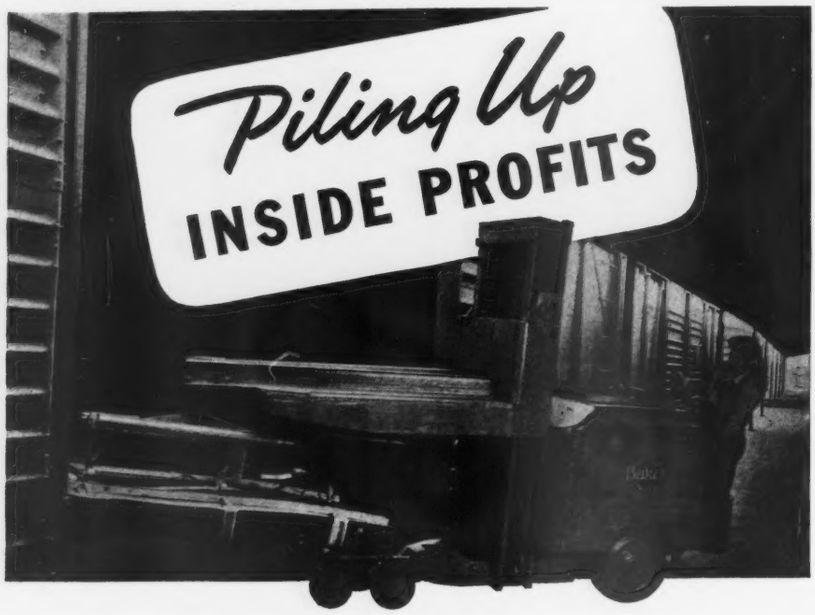
It has been a familiar experience for American families for the last nine years to cut down household expenditures. While family budgets have thus been curtailed, government budgets have expanded in spectacular manner.

The mounting tax burden has meant that the self-supporting person has had to turn over an ever-larger portion of the proceeds of his labor to meet the expense of government. The cost of unemployment relief is a load on all employed persons who must divert part of their own income to support the unemployed.

Each dollar paid by the people in taxes, is a dollar withdrawn from their individual purchasing power. Taxes add to the cost of what is bought, reduce the volume of sales and production, and lessen the incentive for capital to invest.

We believe that the government itself should consider the advisability of lowering tax rates as a means of increasing tax receipts. The psychological and economic effects would be to give industry and its customers a "go ahead" signal, thus promoting industrial production and distribution and consequently raising government income.

We recommend the creation of a non-partisan representative committee



With competition today as keen as you ever have seen it—with hourly rates moving up as work hours go down—your management is looking for every possible way to reduce costs.

Any achievement that shows a saving represents an Inside Profit. Many companies have made a profit by reducing handling costs—from siding to storeroom, from storeroom to machines—from machines to shipping platform—with Baker Industrial Trucks.

As a specific instance, The Baker Truck shown above, enabled one company, unloading steel from box cars, to reduce the cost from $28 to $5 per car—an Inside Profit of $23.

You are not short-sighted if such savings in your plant are not apparent to you. Planning inside truck operation is a specialized job,—a job for the Baker Man whose experience enables him to look over your plant and to make definite recommendations that will lead to Inside Profits.

Call the Baker Man today.

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2. TOUGH JOB? Certainly—any 1 floor, all-glass building as large as this is considered a hard one to heat. But one Carrier Heat Diffuser, (indicated by arrow) maintains a constant temperature of 70° with a variation never exceeding 2°. What's more, by actual meter test, the cost of heating per square foot is exactly the same as for conventional factory structures.

Ask about the NEW line of Carrier Unit Heaters

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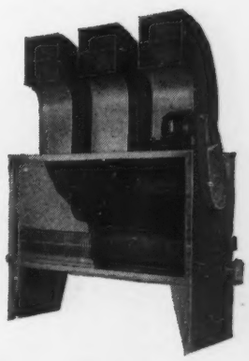
Ask your local Carrier dealer to tell you more about the Carrier Unit Heaters—how they can reduce your fuel bills—20% to 30%—reduce your heating investment substantially—and assure maximum working comfort. Or, if you prefer, mail coupon for latest descriptive booklets. No obligation!

3. RECEPTION ROOM and offices are heated by the same Carrier Heat Diffuser—simply by adding ductwork, and diverting a portion of the heat. Satisfactory? 100%! And it's satisfactory in hot weather, too—when the quiet Carrier fans keep air in motion, and provide positive ventilation.

4. HERE IT IS . . . the type of Carrier Heat Diffuser used in the Nichols Laboratory. Among its many exclusive features are (1) non-ferrous coils, constructed with famous Carrier return bend principle which eliminates strains due to expansion and contraction, makes leakage virtually impossible. (2) Specially-designed fans, which assure economy, make noise and virbration negligible.



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to study the whole tax problem and make suggestions for complete scientific revision, clarification, and simplification of all forms of national, state and local taxes.

7. Government Economy

Useful and necessary expenditures by government must always be provided for, but the time has come for a better understanding with respect to the portion of the total national production which can be diverted to governmental purposes without causing a loss of jobs and lowering living standards.

We recognize the value of accurate accounting by industry and believe that the same standards should be pursued by government in preparing its own financial reports, thus enabling the citizen to understand the operations of his government.

We advocate widespread adoption of the spirit as well as of the letter of the civil service system in the selection of government employees, as a means of promoting both efficiency and economy.

Manufacturers should never overlook the fundamental processes of the private enterprise system in constantly improving production, lowering costs, and passing as much as practicable of these benefits to the public through lower prices. We believe it is equally important for government to improve the efficiency of its services and lower the cost of government to the public.

8. Government Competition

The function of the government is primarily political, not economic. It was neither conceived nor constructed to compete with its own citizens in the production and distribution of the things used by the people.

Government business will invariably destroy private business when in competition with it. Private enterprise cannot compete successfully with enterprise carried on by government. In the final analysis deficits when created by government enterprise are always paid by the taxpayer.

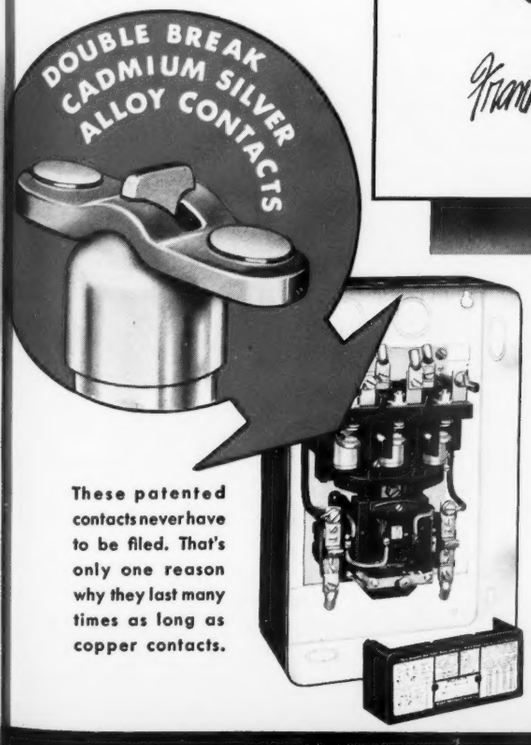
If and when public enterprise is undertaken, the field in which it is to operate should be clearly defined and shut off from the area in which private enterprise functions.

Continuing and increasing government competition with private enterprise is a major deterrent to the flow of job-creating capital into business.

9. Foreign Trade

Although national progress is to some extent affected by international factors beyond our control, this is less

(Continued on page 118)



These patented contacts never have to be filed. That's only one reason why they last many times as long as copper contacts.

"Mama told you those contacts never need filing!"

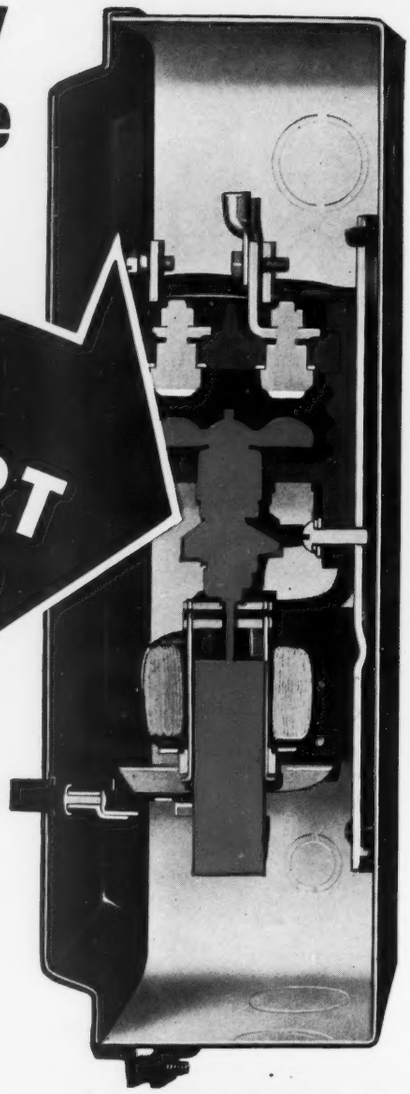
Don't <u>you</u> make the mistake of cleaning or filing the contacts in Allen-Bradley solenoid starters. These double break, cadmium silver alloy contacts are always in perfect operating condition. Oxides which may form on them do not interfere with their satisfactory operation. Allen-Bradley solenoid starters are unusually easy to install, too. No other starter provides such extra large wiring space. All connections are accessible from the front. The white interiors reflect light and illuminate the starter in dark corners. There are lots of knockouts. Save time, money, and trouble by specifying Allen-Bradley solenoid starters on your next job.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

QUALITY

The Secret of Allen-Bradley Solenoid Starter Performance

Only ONE MOVING PART



Cut-away view of the Allen-Bradley solenoid starter. Contacts and solenoid plunger form the only moving part.

In the Allen-Bradley starter, the movable contacts are connected directly to the solenoid plunger—the starter's only moving part. The plunger slides freely in its phosphor bronze guide. Friction-producing parts have been eliminated. There are no complicated mechanisms or flexible jumpers. That's why these starters provide millions of trouble-free operations.

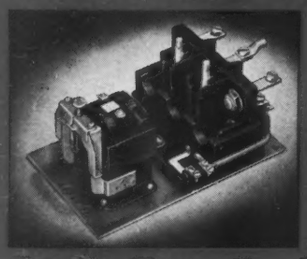
NO PIVOTS-PINS-BEARINGS in Allen-Bradley Solenoid Starters

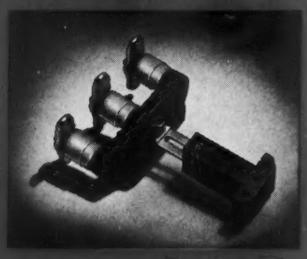
Trouble due to dirty, corroded, or sticky pivots or pins, or delayed bearing action has been done away with. Designers of high speed machine tools can safely take advantage of this starter's precise and consistent operation.

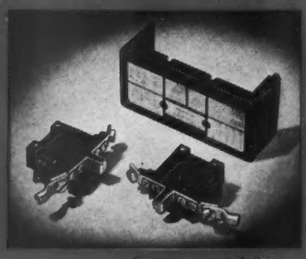
Furthermore, you never need to clean or file the double break, cadmium silver alloy contacts on Allen-Bradley solenoid starters. Valuable contact life is not wasted. Maintenance expense is saved. And, these are not the only advantages of the Allen-Bradley solenoid starter! Write for booklet.

Allen-Bradley Co., 1321 S. First St., Milwaukee, Wis.

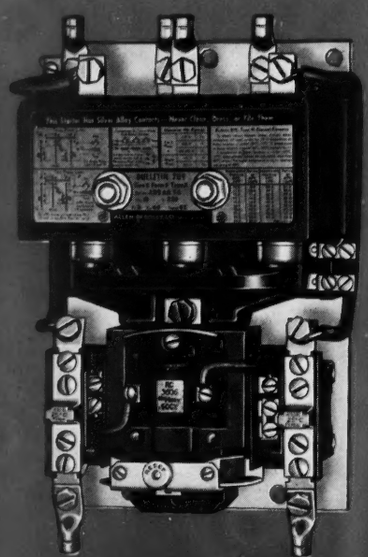
This Basic Unit + This Movable Contactor + Two Relays and Arc Hood Cover = Allen-Bradley Solenoid Starter





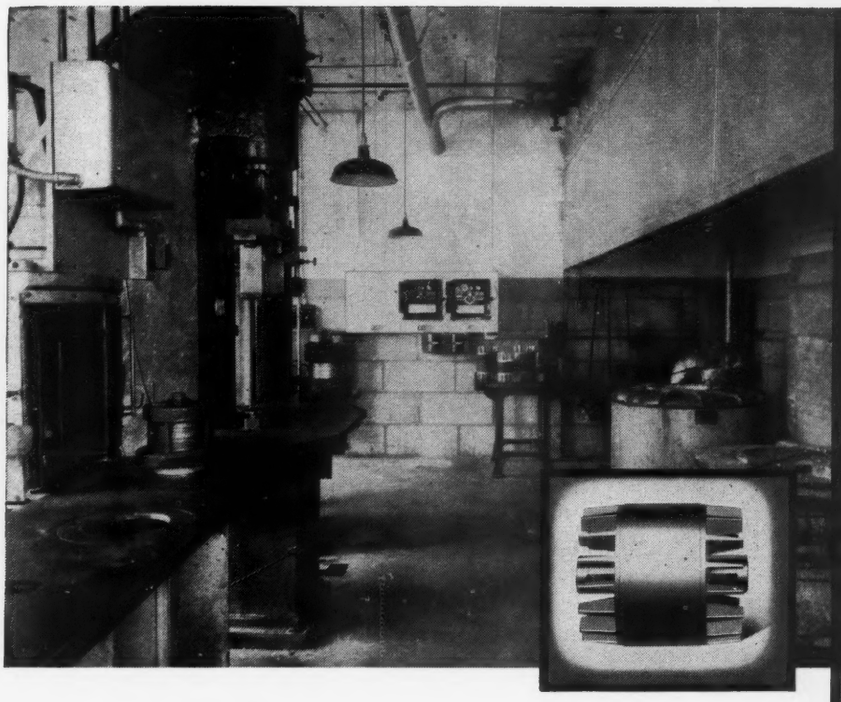


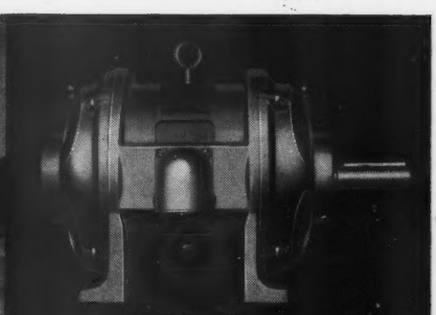
Such Simple Construction Prevents Trouble



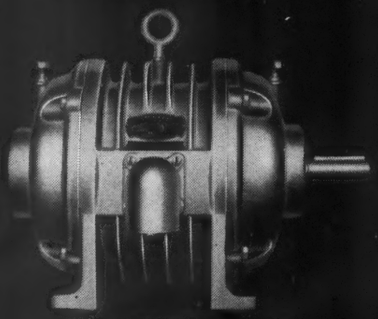
Bulletin 709 Solenoid Starter for across-the-line motors. Can be furnished in any one of seven different enclosures.

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

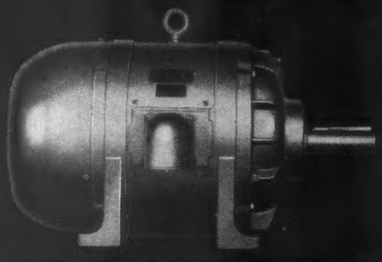




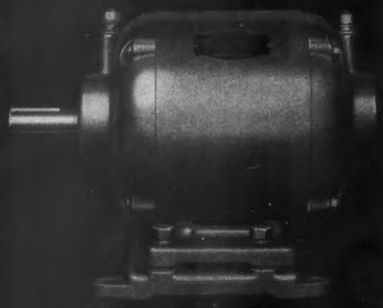
Open Frame, Sleeve or Ball Bearing



Totally Enclosed Ball Bearing



Totally Enclosed Fan-Cooled Ball Bearing

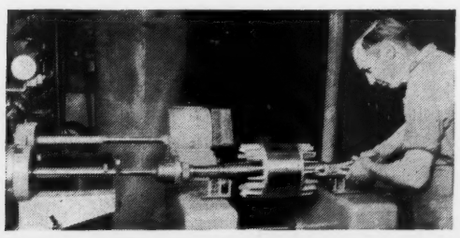


Fractional Horsepower Motor

AN ORDINARY-LOOKING ROOM —for an extraordinary operation

The rotor casting room at Delco Products may *look* uninteresting—but what takes place in this room will interest every engineer who specifies or purchases electrical motors. In this room Delco employs a superior type of die-casting to cast conductors, end rings and fan blades as a unit—no solder, loose rotor bars or fan blades. Structural weakness, that sometimes results from castings where pressure is supplied by gravity only, or where the die is cast from two sides and depends on fusion, is eliminated. *Delco rotors are cast by high pressure in a single uniflow direction,* and every rotor is as sound and sturdy as modern manufacturing methods can make it!

But this room is remarkable as well for the extreme care exercised here. In the great electric melting pots the temperature of the molten aluminum is held at correct point. When ready for casting, both the rotor core and the mold are preheated to the proper temperature to prevent possible chilling of the aluminum and to assure the uniformity of rotor structure. These outstanding features are typical of every operation at Delco Products. That is why we ask you to *look within* the motor you specify.



EVERY DELCO MOTOR IS DYNAMICALLY BALANCED

No motor leaves Delco Products that has not been dynamically balanced on a specially-designed balancing machine. Delco balances every motor. Each end of the rotor and shaft is first balanced independently while the machine indicates exactly how much compensation is required and where it should be applied. After all adjustments have been made, the complete rotating assembly is given a final check. Delco motors assure satisfactory balance.

• • •

Delco industrial AC motors are available in various types, possessing electrical and mechanical characteristics to meet practically every requirement.

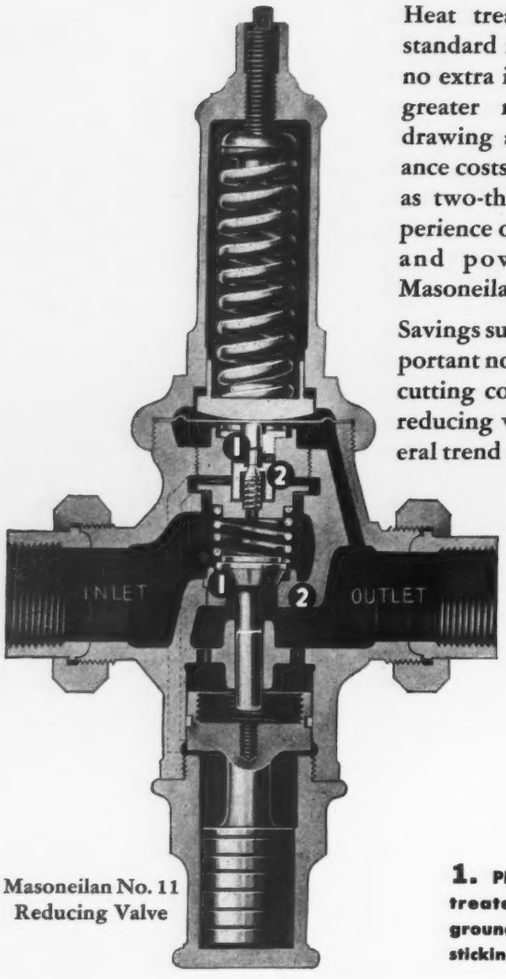
Normal starting torque—normal starting current—high starting torque—low starting current—as well as high slip. Each type available in open frame, sleeve or ball bearing—totally enclosed ball bearing—totally enclosed fan-cooled ball bearing—also multi-speed motors. Electrical and mechanical modifications available. Delco motors comply with NEMA standards.

DELCO MOTORS

DIVISION OF GENERAL MOTORS CORPORATION

DELCO PRODUCTS • DAYTON OHIO

Save UP TO 67% ON REGULATOR MAINTENANCE COSTS



Masoneilan No. 11 Reducing Valve

Heat treated stainless steel trim is standard in these reducing valves—at no extra initial cost. And because of greater resistance to erosion, wire drawing and steam cutting, maintenance costs have been reduced as much as two-thirds, according to the experience of the thousands of industrial and power plants using these Masoneilan No. 11 Reducing Valves.

Savings such as this are particularly important now in view of the necessity for cutting costs and the increased use of reducing valves resulting from a general trend to higher boiler pressures.

Modernize your reducing stations now with modern reducing valves—and profit from savings that quickly repay the initial investment.

1. **Pilot valve and main valve heat treated to 500 Brinnell hardness, ground and highly polished to prevent sticking and reduce erosion.**

2. **Pilot valve and main valve seats heat treated to 150 Brinnell hardness to reduce wire drawing and steam cutting.**

Ask your Mill Supply Distributor for complete data — or write for Bulletin No. 64.

1194 ADAMS STREET
BOSTON, MASS., U.S.A.

MASONEILAN

New York Philadelphia Pittsburgh Buffalo Chicago Toledo St. Louis Tulsa Houston Los Angeles

(Continued from page 114)

true of the United States than of most of the other principal nations. We believe that all foreign trade and tariff policies should be related to the needs of the home economy with the objective of protecting the standard of living of the American people, particularly that of the workers and farmers.

Within this framework foreign trade should be encouraged by every legitimate means.

They Buried the Axe

(Continued from page 50)

class rather than a third class pressman. The Company representatives observed that his work has shown marked improvement during the past few weeks, and agreed to rate him as a second class pressman, increasing his rate from $1.00 to $1.125 per hour.

Anthony F——— complained that he should be paid at the same rate as Daniel U——— since he is doing the same type of work. The Committee agreed that the rates should stand as they were—that U——— was a feeder, and could be used as a feeder when necessary, and was given a higher rate for that reason.

Alfred Peabody, business representative of the International Alliance of Machinists, then requests consideration of wage increases for two young apprentice machinists. A. J. Miller, head of the engineering department, points out that the two are doing only the rough work around the machines and are not really receiving apprenticeship training.

"The opportunity," Mr. Miller explains, "just hasn't arisen yet."

"That is not, of course, a reflection on the two men," says A. A. Duryea, another manager. "If they could have been put in bigger jobs, they would have gone along as apprentices very well."

Mr. Peabody: "Then perhaps the word *apprentice* is a misnomer in this case. Let's let it ride for the present, and later on if the management feels that it can give them a little more responsible work, they'll be due for a little more pay."

Under the next heading, "Working Conditions," comes the case of a printing pressman discharged for cause. Minutes of the previous meeting note that the man was told by Edward Neway, business representative of the union, to appear before the committee if he had any grievance regarding his discharge. He fails to appear. End of item.

Next is a report on the work of Projectionist C——— who had been discharged by the company for care-

"WE Watch

COMPARATIVE MAINTENANCE COSTS...

...and use GULF'S *higher quality* LUBRICANTS to keep them down" SAY LEADING EXECUTIVES

"We DISTINGUISH CAREFULLY between LUBRICANTS costs and *LUBRICATION* costs," says this operating executive. "We bring comparative maintenance costs into the picture when we figure our *final* lubrication costs. If maintenance is low while production holds at a steady pace—or increases—we know our *real* lubrication costs are low, even though we've paid a few cents more per gallon for quality lubricants."

That far-sighted viewpoint is helping hundreds of plant men, from Maine to Texas, secure the economies management demands today in manufacturing costs. And it logically leads them to the use of Gulf's higher quality oils and greases. Plant operators find that when these better grades of lubricants are applied as recommended by an experienced Gulf engineer, production flows more smoothly, less time is lost for adjustments and repairs, and maintenance costs are lower. After Gulf quality lubricants have been placed in service, it is not uncommon for plant managers to report savings in maintenances alone amounting to many times the total monthly bill for lubricants!

So we suggest that you *watch comparative maintenance costs* from month to month in your plant, and ask a Gulf engineer to assist you in finding ways to effect savings through improved lubrication. He will work tactfully with your operating men—and they can benefit from his broad experience in the lubrication of machinery similar to yours. Gulf Oil Corporation—Gulf Refining Company, Gulf Building, Pittsburgh, Pennsylvania.

GULF INDUSTRIAL LUBRICATION

5 STEPS
IN *YOUR* INDUSTRIAL RELATIONS PROGRAM

You can *hire* a man in a minute; but wholehearted loyalty and support come gradually. In planning *your* industrial relations program, remember that men and women in any business especially appreciate management's regard for their *personal* welfare . . . self-respect. Here, then, are a few of the "little things" that have helped men say: "I've got a *good* job with a *good* company!"

1 No matter how good a job a man has, his instincts are to *get ahead*. Wise management provides books, trade papers, tools, often definite vocational guidance, to help men toward more responsible jobs.

2 *Preventive* medicine, periodic examinations, first aid, and plant treatment for minor ailments—are fundamental to good industrial relations. Such measures reduce insurance rates, time lost through illness.

3 Proper lighting and ventilation mean increased comfort, as well as efficiency. Good tools and equipment lose value unless men can see to use them. Make regular, all-season check-ups of offices, as well as plants.

4 A plant news-bulletin or newspaper will keep your men informed of company developments—the activities of fellow workers. Make it "personal," up-to-date, interesting, with stories and pictures.

5 Washrooms bring workers face to face daily with management's concern for their comfort and health. Sanitary washrooms, with hot water, soap, and *individual* ScotTissue Towels, go a long way toward building good will.

The Scott Washroom Advisory Service is available to help arrange washrooms comfortably, economically and efficiently. A Scott Engineer will suggest how to relieve congestion, reduce waste and overhead expense, and create good will in plant or office washrooms. Please send for our booklet.

• Scott Paper Company, Chester, Pa. Send me, without obligation, "Scott Washroom Advisory Service."

Name_____

Address_____

City_____ State_____

FM-1

Copr., 1939, Scott Paper Co.

lessness and reinstated at the request of J. Rugge of Local 702. C——— has been on probation for a month. Management reports that he is now doing good work.

"In every case where a union has taken the responsibility of recommending reinstatement," Mr. Coffman observes, "the probationer has done well."

An Impromptu Panel

The session closes with a report on group insurance and an impromptu panel forum on the merits of the Relations Committee. Here are some sample comments:

Mr. Neway: "Frankly we were very skeptical of this idea at first. Now we're very enthusiastic. Incidentally, when we signed the Relations Committee contract, it was the first time our local had ever varied from our standard, iron-bound contract form embodying 32 printed pages of shop practice regulations."

H. Wendrich (business representative of Essex County Printing Pressmen's Local No. 31): "We felt that there was nothing left out of the standard contract that couldn't be settled around the table."

Mr. Coffman: "I think we all agree that there's been a good deal of racketeering on both sides in labor disputes. But I think we can show that if management and labor have confidence in each other they can settle almost any problem through frank and frequent negotiation."

Mr. Peabody: "Incidentally, you may be interested to know that we of the Machinists' Union think so much of the plan that we're trying it out in other plants."

Mr. Neway: "So are we."

And how is it working out?

Mr. Neway: "In one plant very well. In another very badly."

What's wrong?

"Everything," says Mr. Neway. "Fighting all the time. We gave them a voluntary 5-cent wage reduction and now they're after another. But they're not willing to show us where such a decrease would be justified."

Then what will the union do about it?

Mr. Neway, a veteran trade-unionist and plenty hard-boiled, shakes his head grimly.

"We may have to resort to our economic weapons," he says.

"Don't forget that your contract is enforceable in court," Mr. Coffman reminds Neway.

The unionist looks dubious and remains silent.

Well, that little passage is cited to demonstrate two points: (1) Although

NEW *Economy* IN MATERIAL HANDLING

Plug in to an ordinary lamp socket (single phase) or a 220 or 440 volt power line.

The new COMET ELECTRIC HOIST can bring reduced costs into your plant. At a new low price level and very low operating cost, you can now have the economy—speed—convenience of COMET ELECTRIC HOISTS.

Those many lifting jobs throughout your plant take valuable time—delay production—tire your workmen. COMETS save time—speed up production—make your workmen and machines more productive—also—handling material overhead saves valuable floor space.

Analyze your lifting jobs—intermittent or continuous—and use COMETS to save money for your company. A small investment will pay big dividends in increased profits. Write for literature.

4 Capacities

250 lb. . . .	$130
500 lb. *(shown above)*	130
750 lb. . . .	155
1000 lb. . . .	155

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(Division of Columbus-McKinnon Chain Corp.

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CM COMET

FOR OVERLOADS

Borrow the "Burro" Idea

The prospector picks on the burro to carry his mountainous pack because the little fellows can haul a load that would stump an elephant. They qualify for the job because they provide *greater carrying capacity* along with the ability to *keep going without breaking down* . . . two qualities that you'll always find in Rockbestos wires, cables and cords.

When you run new circuits or rewire old ones that have been laboring under overloads, remember the burro and use Rockbestos for its greater carrying capacity. Its asbestos insulation withstands the conductor heat developed by overloads because it does not dry out under heat. It eliminates fire-hazard because it won't burn. And it's often more economical than the so-called cheaper wires because its greater carrying capacity permits the use of smaller wire and saves conduit replacement.

If you have an overload condition that is becoming a problem or want to guard against such a condition, let us help you. Rockbestos wires, cables and cords, made to meet severe conditions, are resistant to heat and moisture, oil, grease and corrosive fumes. Write for samples or information. Rockbestos Products Corporation, 908 Nicoll St., New Haven, Conn.

Also refer to Electrical World Buyer's Reference.

IF YOU HAVEN'T SENT IN FOR YOUR COPY OF THE NEW NO. 10-E BULLETIN . . . WRITE TODAY!

OTHER ROCKBESTOS FEATURES

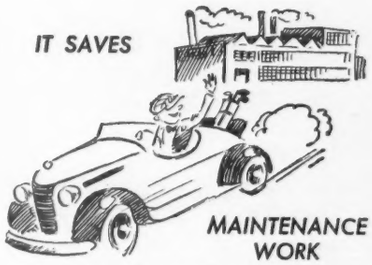
IT IS HEATPROOF

Rockbestos insulation, made of asbestos, does not deteriorate under heat. It's flameproof, too.

IT IS PERMANENT

Rockbestos is always "as good as new" because asbestos is naturally time-resistant.

IT SAVES MAINTENANCE WORK



Rockbestos wired circuits eliminate frequent and expensive replacement.

IT IS VIBRATION-PROOF

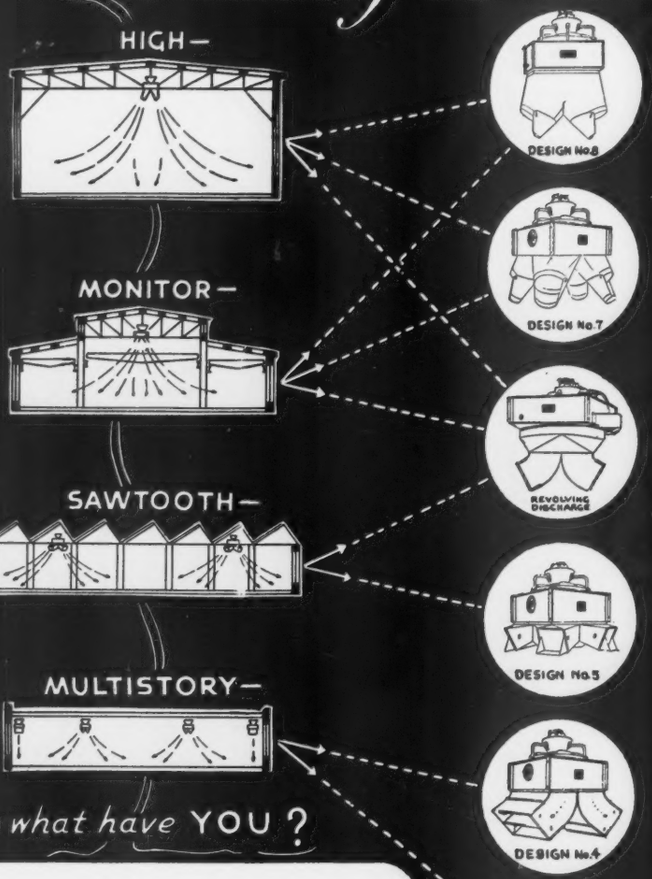
Rockbestos insulation won't dry out, crack, open up, or fall off.

IT WILL NOT BLOOM

Rockbestos won't rot, bloom or swell under action of oil, grease or fumes.

ROCKBESTOS A.V.C.—*the wire with permanent insulation*

Tailored-To-Your-Building HEATERS!



or what have YOU?

Seventeen years ago Wing introduced the *original* WING Floodlight method of heating, and has been making new records of heating efficiency ever since.

HOW?

With the exclusive WING Tailored-to-Your-Building features.

The WING Featherweight Unit Heater is the *Only* heater that offers discharge outlets specifically designed to YOUR particular building conditions, and assures you the most effective heat projection, distribution and diffusion at lowest cost.

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(The Pioneer of Ceiling-Suspended and Lightweight Unit Heaters)

162 W. 14th St. NEW YORK, N. Y.

Wing *Featherweight* UNIT HEATERS

Floodlights of Heat

the Relations Committee is successful at Consolidated, it does not necessarily portend the dawn of the millennium in labor relations; (2) nobody has sprouted wings at Consolidated for that matter. Yet the fact remains that the plan *is* working for Consolidated. Why?

"Because," says Mr. Neway, "we trust them and they trust us."

How would the idea work if there were a CIO union here in the Fort Lee plant among all the AFL unions?

Mr. Peabody of the Machinists answers that one promptly.

"Impossible," he says, horrified. "It wouldn't work at all."

One Plant All CIO

That remains in the realm of theory, anyway, until put to the practical test. Meanwhile the company reports that one Consolidated unit, the Bridgeport plant, is fully organized by CIO and functioning smoothly with a Relations Committee.

One case history demonstrates the worth of the plan to the company. In Scranton, John Q——— was one of the most rebellious workers in the plant before the strike and a leader in the strike. Later he became a member of the Relations Committee. As the committee progressed, he became more and more interested in plant problems. Ultimately he came through with so many constructive suggestions that he was named a foreman.

"Do you know," said John Q——— later, "I think the thing that was really biting me was that nobody would listen to my ideas."

The Essential Factors

Judged by Consolidated's experience, these factors are essential:

1. The management must concede full union recognition without quibbling.

2. The union must concede a no-strike proviso without quibbling.

3. Both must park their shooting irons outside the conference room. Both must recognize that the time and money the company spends in developing a man in a job is an investment by the company, that the time and effort a man puts into learning a job is an investment on his part, and that both investments must pay.

4. *Both must be absolutely fair.*

Finally, both must do their utmost to make the committee understood and appreciated. The committee gets the credit—and takes the responsibility—for everything that happens. Time and again the Consolidated

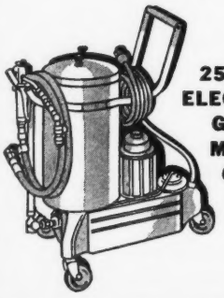
CLEAN LUBRICATION for CONVEYOR SYSTEMS *Insured by* ALEMITE!

FILLER TANK MODEL 6425

Indispensable to most efficient use of Alemite Hand Guns, as shown in Brockelman Bros. photograph; saves time loading guns. Holds 35 lbs. fluid or semi-solid lubricant; delivers 2¼ oz. per stroke; prevents spilling, waste, and contamination. Handle locks for easy carrying; bracket for hand guns.

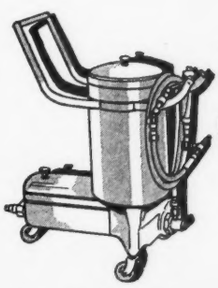
ALEMITE HYDRAULIC HAND GUN MODEL 5586

Holds 9 oz. semi-solid lubricant; quickly filled through filler-type handle with Alemite Filler Tank. Delivers predetermined quantity of lubricant at each shot; up to 10,000 lbs. pressure per square inch. Gun coupling has three jaws which grasp fitting on contact, forming a leak-proof seal. *"The greater the pressure the tighter the seal."*



25-LB. ELECTRIC GUN MODEL 6190

Holds 25 lbs. semi-solid lubricant; delivers 12 oz. per minute under pressure of 4500 to 5000 lbs. per sq. in.; heavy duty universal motor for A.C. or D.C. Mounted on 3 casters and easily wheeled about by handle, which also serves as rack to keep hose and electric cord off floor. Complete with hose and control valve.



25-LB. AIR GUN MODEL 6184

Holds 25 lbs. semi-solid lubricant; delivers 10 oz. per minute at 125 lbs. air pressure; pressure developed is 33 times that of available air pressure. Mounted on 3 casters for easy moving; handle serves as hose and cord rack. Complete with hose and control valve.

HIGH PRESSURE FORCES LUBRICANT INTO BEARINGS—KEEPS PRODUCTS, MACHINES, FLOORS CLEAN

THOUSANDS of conveyors of all kinds are getting Alemite Lubrication because manufacturers have found that *the Alemite System is fast, dependable, economical.* But here in the curing department of Brockelman Bros., Inc., Worcester, Mass., CLEANLINESS is also demanded. When George Collins, foreman, was asked what he regarded as the most important advantage of the Alemite System, he replied, *"No contamination of meat."*

This *"no contamination"* feature, added to Alemite's many other advantages, is the reason why Alemite Lubrication has been adopted by countless food plants, textile mills, and other industries where contamination of the product would be a major item of expensive waste.

There is an Alemite System, power or manually operated, specially planned for *your* plant—to help you cut costs, speed production, safeguard important bearings and prevent contamination. *Such a system can be installed quickly, without halting production.* Write us for details!

ALEMITE

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FLOOR MAINTENANCE

40 sizes and types of equipment from which to make selection, a complete line of accessories and supplies, and a nearby Finnell engineer ready to serve.

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Onliwon helps keep healthy men on the job!

This small investment in sanitary washrooms pays big dividends in good health, good work, and good will.

You'll actually *save* by giving your employees the extra protection of Onliwon Towels and Tissue. Dispensed from locked, sanitary cabinets.

Get the facts about this economical washroom service from your local A. P. W. distributor, or write to A. P. W. Paper Co., Albany, N.Y.

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Onliwon Towels and Tissue

The complete washroom service

UNBRAKO

SELF-LOCKING HOLLOW SET SCREW

CAN'T VIBRATE LOOSE ●
PREVENTS BREAKDOWNS ●
AVERTS ACCIDENTS ●

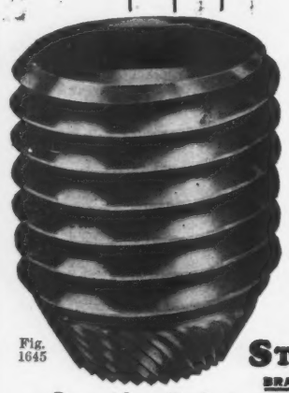

Fig. 1645

You can now be sure that every set screw will permanently perform its intended duty. No longer do you need to wonder and worry whether vibration will cause them to loosen. Equip your machines with the new *"Unbrako" Self-Locking Knurled Set Screws.* Ingenious knurling on the cup points automatically and so surely locks them in place, when tightened in the normal manner, that no amount of shaking, jarring or vibration will loosen them. Maintenance men can entirely neglect them without cause for alarm. Yet, these screws can be easily removed for adjustment if desired and re-used again and again, indefinitely.

Tests made in innumerable mills and under all conditions prove these facts.

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management has seen opportunities to raise wages. Instead of acting voluntarily, it has called the union's attention to a chance to make a successful request for the raise *through the committee.* Frequently the union has pointed out opportunities to lower wage costs, and this, too, has been accomplished *by action of the committee.*

"Applied Democracy"

A two-word definition of the plan would be "applied democracy." Its parliamentary nature is fundamental.

Consolidated received one very tangible reward for its policies when, last year, the molding division of the Scranton plant hit a slump and ran into the red. To the Relations Committee the company presented its books, data on competitive wages, and a request for a 10 per cent emergency wage reduction. While the committee debated, word of the request reached Hugh Gormley, an AFL organizer who had been a leader in the Scranton strike. (Gormley had since moved on to Indiana to become a regional organization director for the Federation.)

Gormley returned to Scranton immediately and at his own expense to throw his weight behind the request. The reduction was accepted.

"When Mr. Coffman said it was necessary," Gormley explained, "I *knew* it was necessary."

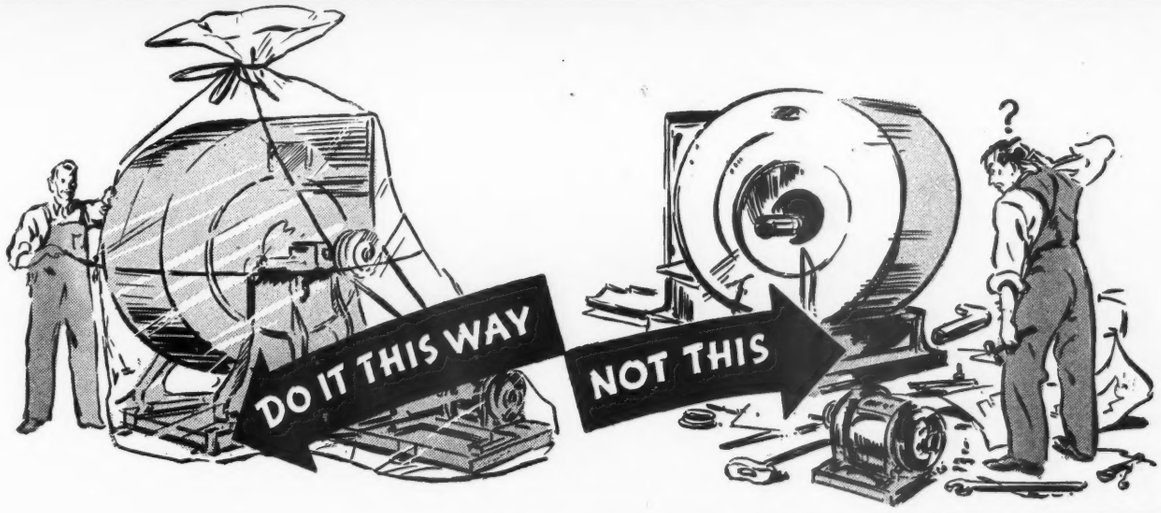
52 Pay Checks a Year

(Continued from page 57)

the departmental production schedules, which may run off at tangents from the general plant curve. These are some of the major problems at first.

The prime necessity is accurate estimating, and then the courage to follow these estimates. When a plant operating man sees a set of hour deficits piling up, it takes courage for him to keep from tampering with the schedule of production per hour—in other words, he has a natural temptation to lay off people rather than gamble on a time deficit that may turn into a money deficit and hence a blot on his operating record. The plant executive who can handle the plan is one that, in full consultation with everyone above or below who might help him to the facts, maps out for a year ahead his anticipated volume and his personnel requirements for each activity. He gives himself a

SAVE LAYOUT AND ERECTION EXPENSE ON YOUR FAN INSTALLATIONS



• Why spend needless hours on layout and erection, trying to make a quiet installation with an assortment of base parts. You can be SURE of noiseless operation by installing Buffalo Limit-Load Fans complete with motor and Silent Floating Base.

These fully assembled and tested units eliminate guesswork and trial and error methods. They operate at high efficiency and cannot overload the motors. Last, but not least, they assure complete satisfaction for many years.

Why not write today for detailed information on these complete, silent, ready-to-install units?

BUFFALO FORGE COMPANY

471 BROADWAY
BUFFALO, N. Y.

BRANCH ENGINEERING OFFICES IN PRINCIPAL CITIES

In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" Limit-Load FANS

Complete with Motor and Silent Floating Base

It's in the groove

When "it's in the groove" to a seventeen year old, it means that some swing band is really giving out. But to a plant superintendent, or anyone else concerned with operation and maintenance . . . "in the groove" means the quality inherent in every American Wedgbelt Pulley that makes it superior to ordinary grooved pulleys.

"American" sheaves are machined to micrometric accuracy and combine the finest in engineering skill and craftsmanship. These grooves do all that grooves *can* do to assure absolutely even belt tension regardless of the number of belts used in the drive. This accuracy assures a minimum of belt wear.

Better balance, better bushings and "air-streamed" arms further contribute to the smooth, silent operation that characterizes American Wedgbelt Pulleys. For most satisfactory operation, and longest life "Americans" can be your only choice.

N. B. ***American Tension Control Motor Bases have a definite application to every V-belt drive. Ask us for the details.***

MODERN PTC GROUP DRIVE

THE AMERICAN PULLEY COMPANY
Dept. 2, 4200 Wissahickon Ave., Philadelphia, Pa.

AMERICAN
PULLEY COMPANY

little margin of safety, but not much. Then he holds to his predetermined plan and makes it come out right.

Once he has done this, Sears experience indicates it will never again be so difficult nor will he fail to improve his performance for the year. It is a good deal like eating the first oyster or olive. As indication of the accuracy that has been attained in three years of practice, the margin of safety now left in the typical schedule is 1 per cent.

Two Plants Without Plan

The two largest Sears mail order plants are, at this writing, not yet on the standard income plan. These two large plants necessarily present the most complex problems, hence it was deemed best to work it out first in the smaller units. Also, because of the uncertainties of maximum-hour legislation, which would limit the advantages of the plant both from the standpoint of employees and of the company, the management has held off.

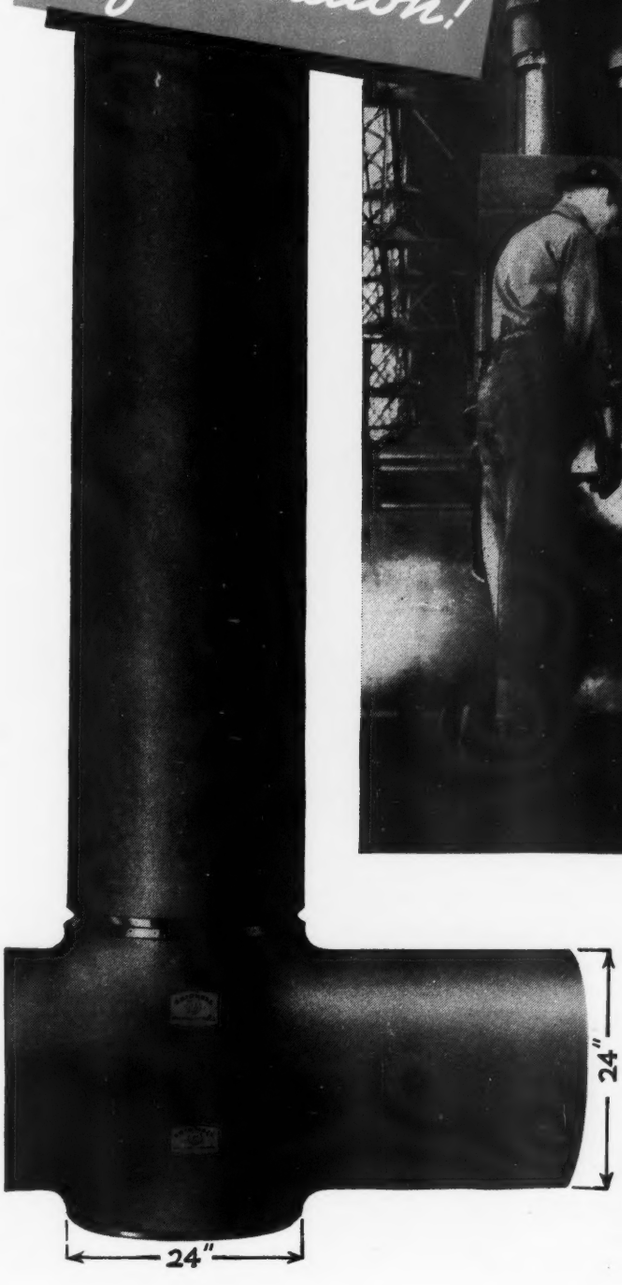
Sears executives stress the point that the most any other company can hope to adopt is the general outline of the plan, that the details of handling the planning, the records and the transfers, and the job of explaining it to the employees must necessarily vary with the individual circumstances prevailing. The answers to the problems that come up can best be worked out locally, as the solution is usually apparent upon examination.

Employees Must Savvy

Sears operating people have felt from the very outset that it was necessary to make employees understand the plan clearly. Therefore, the first step is to explain it thoroughly to department managers and foremen, then have these key men call meetings in working hours to explain the plan to their employees. These key men also encourage questions and carry on individual discussions for days before the final installation. It is particularly important to have the timekeepers know all about it, since they get a lot of questions. The personnel office must be informed, and keep its door open to all comers. Then, after the first natural suspicion that may be expected whenever employees are asked to accept a new plan, it has been the universal experience that Sears people have accepted the plan very favorably.

The standard income plan is, as has certainly been explained here, advantageous for the employees. They get more job security, there is less hiring

PLANT FACILITIES LIKE THIS *Mean Better Prefabrication!*



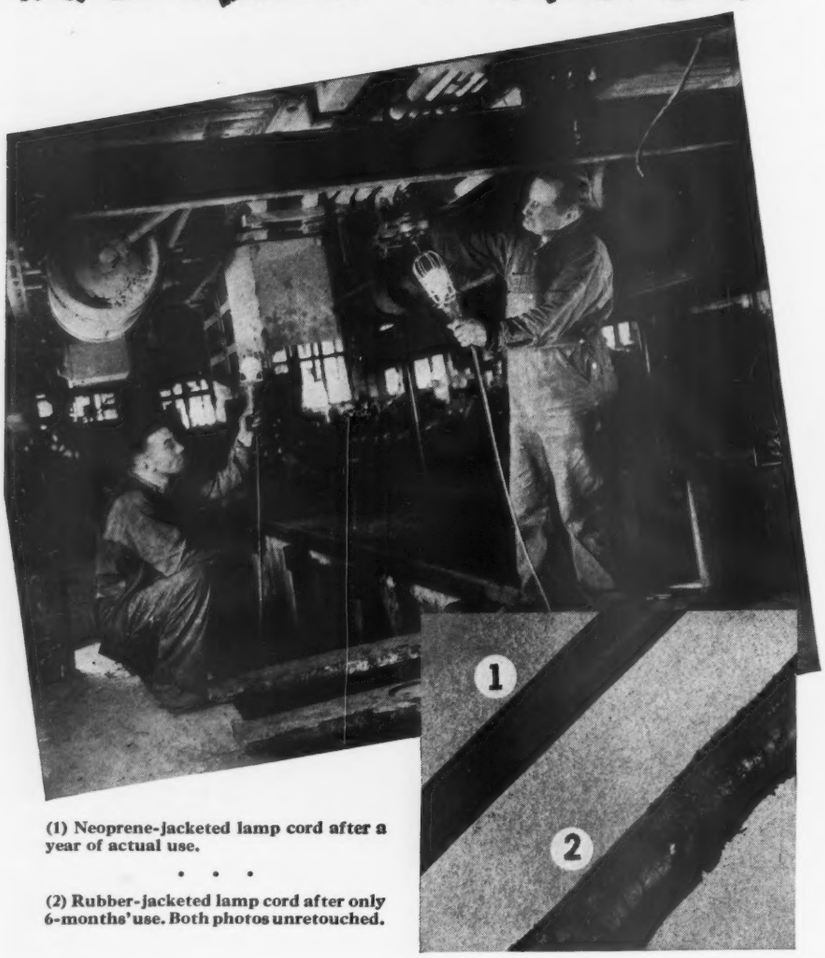
This exclusive Grinnell hydraulic extruding machine permits welded outlets to be made with plain circumferential butt welds — the strongest and easiest welds to make. It is part of the equipment which means better prefabrication from Grinnell.

Interpret Grinnell's facilities in terms of *equipment* like the above . . . in terms of *men* — qualified pressure-welders whose work readily passes insurance requirements . . . or in terms of three *plants,* conveniently located to serve the continent . . . and these facilities will prove the wisdom of your decision to "Give the plans to Grinnell!" Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

PREFABRICATION BY GRINNELL

WHENEVER PIPING IS INVOLVED

HERE'S PROOF



(1) Neoprene-jacketed lamp cord after a year of actual use.

• • •

(2) Rubber-jacketed lamp cord after only 6-months' use. Both photos unretouched.

See how shop test proves economy of neoprene lamp cable

IF YOU'RE in the market for better portable cable at lower maintenance cost (and who isn't?), you can profit by this experience of a city street railway company . . .

The superintendent of this street railway, intent on cutting upkeep costs, decided among other things that lamp cord in the shops needed replacing too often. Oil and grease were rotting the cotton covering.

Experimenting with other covering materials, he found that high-grade rubber jacketing was an improvement over the cotton. But when this rubber jacketing was, in turn, tested against jacketing of Du Pont *neoprene* . . . neoprene won in a walk. Because while neoprene, Du Pont's remarkable chloroprene rubber, has the strength, elasticity and toughness of natural rubber . . . it is far less affected by oils, gasoline, sunlight, ozone and air.

Neoprene covered cord is now standard in this street railway shop. Repair and replacement costs have gone down. And the superintendent's stock, you may be sure, has gone up.

Take the hint. Specify neoprene covering next time you buy portable cable. Look for neoprene parts in other equipment you buy. That's your assurance of top quality, long service, and lowest maintenance cost.

DU PONT NEOPRENE

E. I. DU PONT DE NEMOURS & CO., INC.

RUBBER CHEMICALS DIVISION, WILMINGTON, DELAWARE

and firing, less variation in income between seasons—they are better off in every respect by reason of it. As for the company, it gets the benefits of bettered employee relations. It gets a number of major savings through lessened employment costs and lessened training costs. Also, as it works out, operating costs are favorably affected because the plan puts the plant management's emphasis on holding the hourly production schedule level and varying the hours, rather than varying the hourly output and varying the personnel requirements to hold the hours more level. Everyone is better off.

Audit Your Pay Plan Now

(Continued from page 71)

ory that a stitch in time saves many.

Good factory planning can eliminate practically all idle time that is due to material shortages and breakdowns. That elimination is a duty of management.

The start and end of idle time should be recorded, and the employee should be paid an hourly rate for such time. In some plants that expect idle time to be recorded and paid for, negligent foremen fail to record the time because they think it reflects on their foremanship. Under such foremen, workmen are deprived of fair treatment.

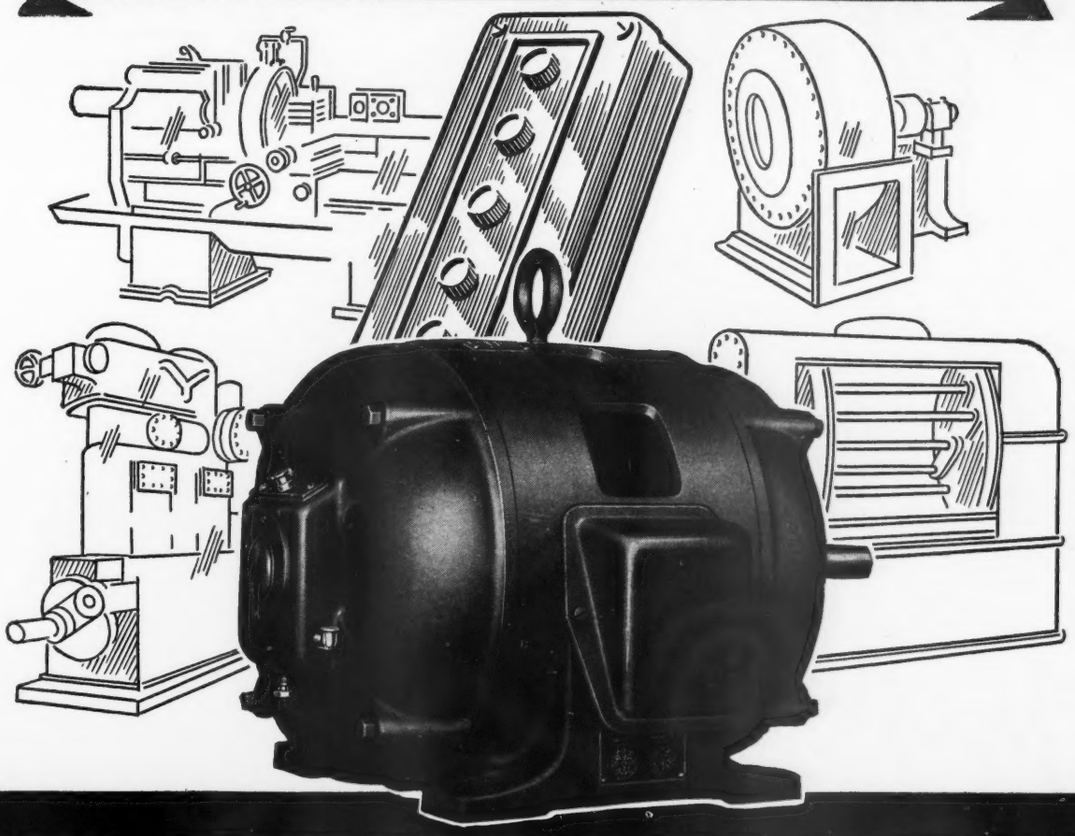
Idle time may result from many of several other reasons—seasonal sales, inadequate equipment, too many or too few operators at certain work places. Lack of versatility among employees or inefficient foremanship may prevent prompt shifting of personnel as the amount of work varies.

All of these mean reduced earnings for employees. Management should, therefore, attempt to:

1. Smooth out the sales curve.
2. Eliminate bottle necks in the production line.
3. Provide just the right number of persons at each workplace.
4. Provide versatile workers and shift them promptly as work volume varies.
5. Raise hours of work per week in busy seasons and lower them in slack seasons.

If, however, unavoidable fluctuations of work occur, an employee should be transferred to some unaccustomed job, if possible, and paid his hourly rate, which is less than his usual incentive earnings. This should

PUSH A BUTTON.. *THIS MOTOR CHANGES SPEEDS*



MAKE EQUIPMENT MORE FLEXIBLE

GET 4 SPEEDS WITH ONE CENTURY MULTISPEED SQUIRREL CAGE INDUCTION MOTOR

REGULATE tool speed requirements—get as many as 4 speeds — change air volumes on blowers—by merely pushing a button . . . handle amounts of refrigeration . . . get different speeds for conveyor rate of travel . . . apply multispeed to other processing applications—all possible with this one motor.

You'll find Century Multispeed Squirrel Cage Induction Motors handling some of the toughest jobs you can imagine—more economically—more profitably—more conveniently than a lot of users thought possible . . . and you'll also find there's a surprising lack of vibration—due to precision built armatures which are statically and dynamically balanced . . . at both ends.

It's entirely possible that Century Multispeed Squirrel Cage Induction Motors might permit you to "press the button—change the speed"... a control feature, which is simple and economical.

At least, it will pay you to investigate, and learn how others are now benefitting by these standard type, easy change control motors. Write for further information now—tell us your problem — while you are thinking about it.

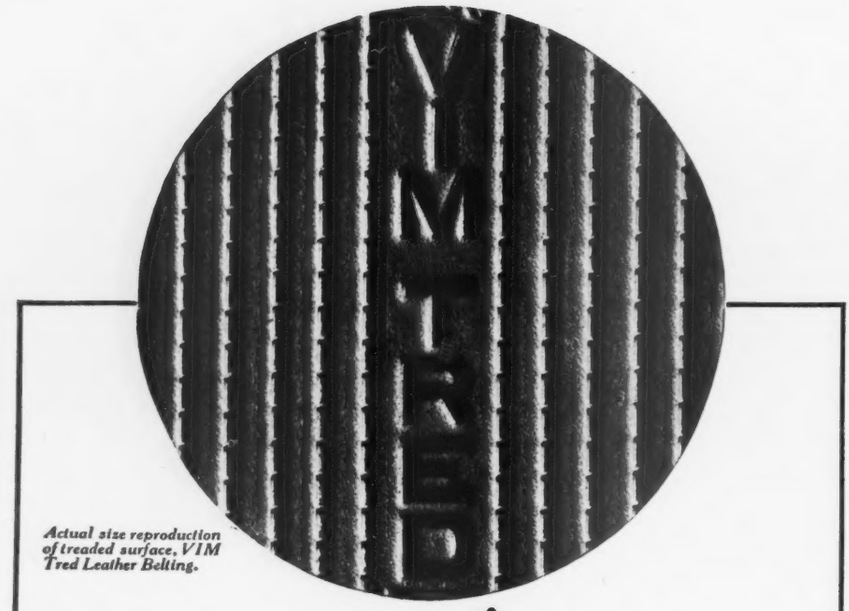
Century MOTORS

CENTURY ELECTRIC COMPANY

1806 Pine Street • • • St. Louis, Mo.

Offices and Stock Points in Principal Cities

ONE OF THE LARGEST EXCLUSIVE MOTOR MANUFACTURERS IN THE WORLD



Actual size reproduction of treaded surface, VIM Tred Leather Belting.

Treaded

Leather Belting . . . . . .
exclusive with Houghton;
providing increased pulling power!

Certified

to cost you less
per unit produced!

This certificate is attached to each VIM Tred Leather Belt shipped from our factories and warehouses.

This is to
CERTIFY
that this
VIM TRED Leather Belt
Made from highest quality heavy hides and tanned by the exclusive VIM mineral process - - -
will cost less per unit produced than any other belt under identical conditions. If for any reason this belt should not justify this claim, adjustment will be made.
E. F. HOUGHTON & CO.
240 W. Somerset St.
PHILA., PA.

be done in preference to sending him home.

If an employee is transferred to unaccustomed work because absences or sudden production requirements demand that a regular force on a given operation be augmented, he should not suffer by being required to accept lower earnings. His average rate of earnings should be paid while he remains on the job.

Reduced costs that are the result of better conditions and methods should be translated fairly quickly by the employer into higher pay for his employees, lower prices for his consumers, as well as larger profits for himself. The business that equitably distributes these savings among the three beneficiaries is likely to be more stable and more profitable in the long run, because such treatment builds employee good will, minimizes competition, and maintains or increases sales.

When an employee has devised a better method, better tool, or better machine, the better way should be adopted as standard, and, whether the change makes the operation faster or slower, the standard time should be checked, and changed upward or downward to make it right. The wise employer compensates the employee for his idea according to a definite rule. If the reward is a lump sum of money, the operator will go back to work on the new standard time, which may be higher or lower than the old. If lower, the operator has reduced his earnings per unit but, if the standard is right, his hourly earnings will not be affected.

If an employee saved time by bettering a method, one company rewarded him by allowing him to continue working on the old, high standard time or rate. This, in effect, gave the operator a continuing bonus so long as he remained an employee of the company and on that work. Any other operator working on the job worked on the new standard. Promotions and vacations with pay are other forms of reward for ideas. Whichever method is adopted, it should be definite, fair, determined in advance, and known to the employee.

Employees on some forms of bonus complain that they cannot compute earnings accurately day by day, but must wait until pay day to know just how much money was earned. The alternative is to pay the employee his hourly rate and not attempt incentives.

Some group bonuses have been criticized for being individually inequitable, and, generally, an individual bonus is to be preferred to a group bonus. There are places, however, where the only alternative to a group bonus is no bonus at all.

BLAW-KNOX *Electroforged* GRATING

-the choice of industry *because*

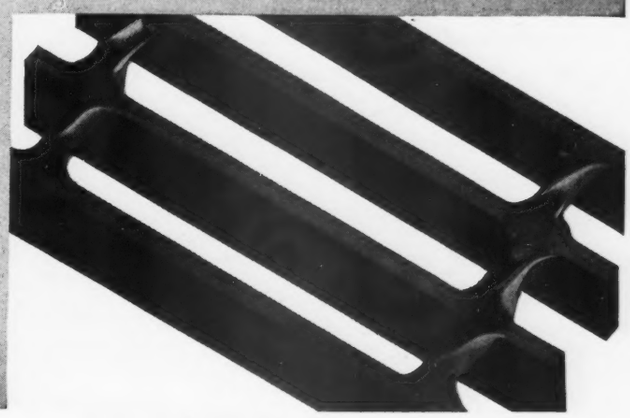
Maximum open area for light and air

Safest footing because of the twisted bar

Easily maintained no cracks, or crevices, paint reaches entire surface

Electroforged one piece construction strongest by test

Self cleaning no sharp corners to clog with debris



Send for free paperweight size sample.

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Rolls—Rolling Mill Equipment—High Temperature Furnace Equipment—Welded Pressure Vessels and Equipment for Special Processes
Steam Purifiers
Construction Equipment
Radio Broadcasting Towers
Standard Steel Buildings
Clamshell Buckets
Steel Castings
Alloy Castings
Power Piping Systems
Automatic Sprinkler Systems
Electrochemical Process Units

USE THE COUPON

BLAW-KNOX DIVISION of Blaw-Knox Co., 2031 **Farmers Bank Bldg., Pittsburgh, Pa.**

NAME _____ COMPANY _____

STREET _____

CITY _____ STATE _____

LIGHTNING QUICK

In Killing FIRES

Uses the fastest known extinguishing agent
Requires no annual recharging—Will not freeze

LUX FIRE EXTINGUISHERS WILL smother industrial fires faster for two good reasons. First, Lux carbon dioxide snow-and-gas is the fastest recorded extinguishing agent. Second, Lux equipment is *engineered for industrial use.* It is best for electrical and flammable liquid fires, the most common industrial fire hazards.

LUX FIRE EXTINGUISHERS WILL *NOT* harm men nor materials. They cause no harmful fumes. Lux carbon dioxide gas is clean, dry. No wetting action, no corrosion, no damage. No annual recharging needed, either. Does not freeze at any climatic temperature, nor deteriorate.

Keep Production Moving Along

Lux *Fixed Systems* protect industry's most dangerous fire hazards. Lux *portables* are best for general plant protection. And remember — Lux kills fires *faster* . . . prevents cost-consuming shutdowns. Better get Lux protection.

"Instant Death to Fire" is a brief, informative folder describing Lux portable extinguishers. Write today for your free copy.

Walter Kidde & Company, Inc.
12 West Street, Bloomfield, N. J.

TRADE LITERATURE

Air Compressors — Bulletin H-620 B8A. VA and VA-2 compressors—rating and dimensional tables, and sectional views.—Worthington Pump & Machinery Corp., Harrison, N. J.

Air Switches — Bulletin 517. Air Switches for manual or remote control, for electrically- or air-operated valves. —Bristol Co., Waterbury, Conn.

Arc Welding—Bulletin 401-A. Equipment for arc welding mild steel and other metals; electrodes, and accessories.—The Lincoln Electric Co., Cleveland.

Belting—Folder 205S. Description and price sheet on "Tannate" rounded belting.—J. E. Rhoads and Sons, 35 North Sixth St., Philadelphia.

Chemical Surface Treatment—Bulletin 7-11. Process for protection of metal parts by immersion in a boiling solution of Thermoil-Granodine.—The American Chemical Paint Co., Ambler, Pa.

Clamps, Pliers, and Gages—Folder. Dimensions and applications of toggle clamps and pliers, and spring gages.—Knu-Vise Products Co., 6432 Cass Ave., Detroit.

Controls—Bulletin 521. Two models for the protection of gas-fired ovens and furnaces.—Bristol Co., Waterbury, Conn.

Diesels—Bulletin 455. Specifications, construction, pressures, power, combustion, and operation of Model M Diesels. —Venn Severin Machine Co., 1317-1327 West North Ave., Chicago.

Dowel Pins—Chart, Drill and reamer sizes for dowel pins.—Danly Machine Specialties, Inc., 2104-2130 South 52d Ave., Chicago.

Drives—Catalog 638. Typical installations of high-speed silent chain drives. —Ramsey Chain Co., Inc., Albany, N. Y.

Dust Elimination — Booklet. "Industrial Dust Control Through Exhaust System."—Pangborn Corp., Hagerstown, Md.

Electric Hoist—Folder P-388. "The Cable King" air-cooled electric hoist.—The Yale & Towne Mfg. Co., Philadelphia.

Engineering Service—Booklet. Generally descriptive of activities and policies of the firm.—Commonwealth Engineering Corp., Dayton, Ohio.

Filter—Form GPE-97, and Folder. Fire-proof air filter for heating systems. Folder shows application to a "Newcomb" automatic gas-fired heater. —Air-Maze Corp., 812 Huron Road, Cleveland.

Fire Protection—Pamphlet. Article on "Building Exits for Fire Safety"; also the Building Exits Code.—National Fire Protection Association, 60 Batterymarch St., Boston, Mass.

Fire Protection—Folder. "Four Ways to Prevent Freeze-Ups in Sprinkler and Standpipe Systems."—Rockwood Sprinkler Co., 38 Harlow St., Worcester, Mass.

Fire Protection—Folder 1-497. "Fire-Fog" systems for protection of outdoor electrical equipment.—Walter Kidde & Co., Inc., 140 Cedar St., New York.

Flexible Shafts—Catalog 38. Uses of flexible shafting, attachments, and equipment.—Stow Mfg. Co., Inc., 3 Shear St., Binghamton, N. Y.

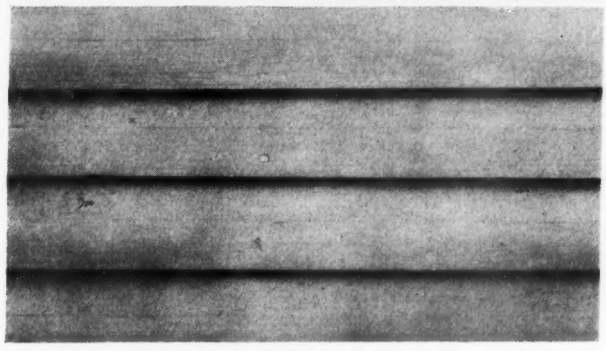
Furniture — Catalog. Metal Royalchrome furniture for offices.—Royal Metal Mfg. Co., 1138-40 South Michigan Ave., Chicago.

Gas Instruments—Three Forms. Methane Content tester (DN-3), benzol indicator (DM-3), and hydrocyanic acid gas detector (DZ-1).—Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh.

Hard-Facing Rods — Form 2267D. Oxy-acetylene process of protecting wearing surfaces, and the materials to use.—Haynes Stellite Co., 205 East 42d St., New York.

Highways—Pamphlet HB 14. Requirements in design and construction

Buy more PAINT-YEARS with Aluminum Paint



WHAT'S A PAINT-YEAR? 365 days of paint durability. On steel roofs and siding you get more paint-years with Aluminum Paint because of its exceptional resistance to weathering and corrosion. It reduces interior temperatures in the summer and cuts down heat losses in the winter.

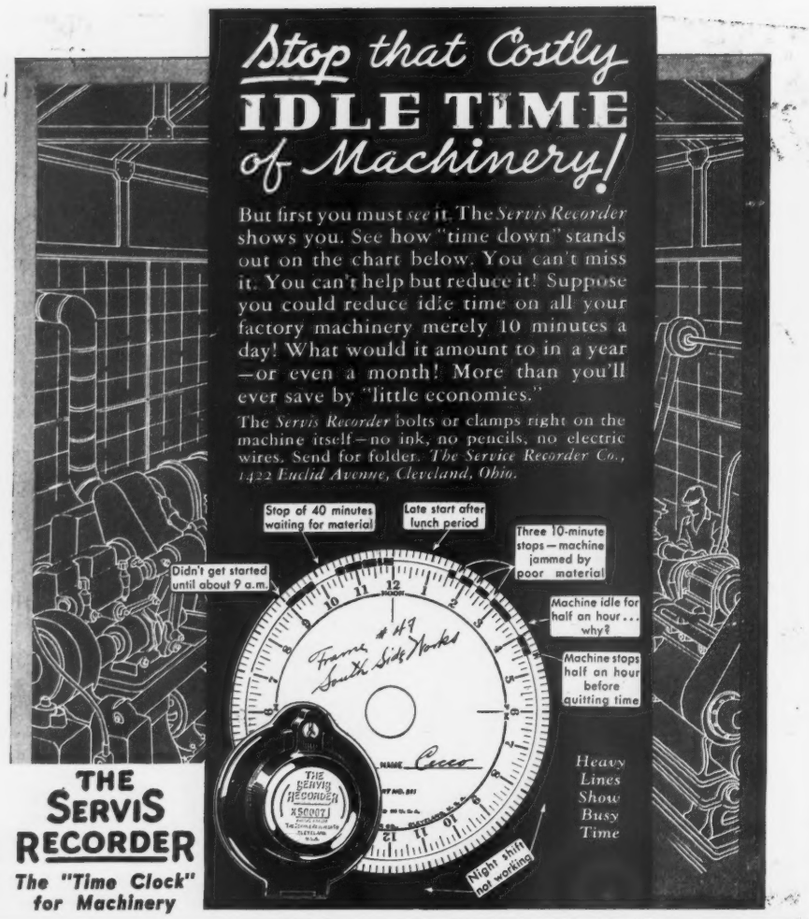
COMPANY HOUSES have proved that Aluminum Paint will give you the most paint-years on wood. On this house a two-coat job lasted 6 years. A 1-coat repaint job lasted another 6 years. The close-up shows the excellent condition of the Aluminum Paint at the 5½-year mark.

FOR MAINTENANCE ENGINEERS. This Aluminum Paint Manual gives complete technical data, formulas and specifications for the proper types of Aluminum Paint for different services. Write for a copy. ALUMINUM COMPANY OF AMERICA.* 2126 Gulf Building, Pittsburgh, Pennsylvania.

Reg. U. S. Pat. Off.
ALCOA ALUMINUM
ALBRON Paste for

We make no Aluminum Paint; only Alcoa Albron Paste and Powder, the pure Aluminum pigments you get in leading brands of Aluminum Paint.

ALUMINUM PAINT


Stop that Costly
IDLE TIME
of Machinery!
But first you must see it. The Servis Recorder shows you. See how "time down" stands out on the chart below. You can't miss it. You can't help but reduce it! Suppose you could reduce idle time on all your factory machinery merely 10 minutes a day! What would it amount to in a year —or even a month! More than you'll ever save by "little economies."
The Servis Recorder bolts or clamps right on the machine itself—no ink, no pencils, no electric wires. Send for folder. The Service Recorder Co., 1422 Euclid Avenue, Cleveland, Ohio.
Stop of 40 minutes waiting for material
Late start after lunch period
Three 10-minute stops—machine jammed by poor material
Didn't get started until about 9 a.m.
Machine idle for half an hour... why?
Machine stops half an hour before quitting time
Heavy Lines Show Busy Time
Night shift not working
THE SERVIS RECORDER
The "Time Clock" for Machinery

INTERESTING DISCOVERIES THAT LED TO IMPORTANT PRODUCTION SAVINGS

#3 BRASS DRAWINGS

THE PROBLEM

To draw pieces of brass tube, elongating them from 4" to 7" without rejects.

THE ANSWER

Drawing these with the help of MAGNUS DRAWING LUBRICANT all trouble and difficulties eliminated.

The above actual photograph shows the four simple steps of this brass drawing operation easily accomplished with the use of MAGNUS DRAWING LUBRICANT.

The material previously used "ground up" the machine and was very hard to wash off the parts.

MAGNUS DRAWING LUBRICANT flows evenly over the entire surface of the finish with plenty of adherence. No rejects. Punch no hotter. Solution rinses more easily.

Let us show you how MAGNUS DRAWING LUBRICANT and other MAGNUS Metal Lubricants will cut your costs, give you better work—and materially increase your profits in other ways as well.

Write today for a nearby MAGNUS SERVICE REPRESENTATIVE to demonstrate to you under your own plant conditions. Or, send us the details of your operations for our specific recommendations.

NO REJECTS

RINSES MORE EASILY

MAGNUS CHEMICAL COMPANY

Manufacturers of Cleaning Materials, Industrial Soaps, Metallic Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants

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MAGNUS CLEANERS

of concrete industrial driveways.—Portland Cement Assn., 33 West Grand Ave., Chicago.

Hoists—Folder. Frequency relay magnetic control, with counter-torque lowering for a.c. crane hoists.—The Electric Controller & Mfg. Co., 2700 East 79th St., Cleveland.

Hoists—Catalog H 106. Line of "Hi-Lift" hoists for indoor and outdoor use, ratings, and dimensions.—Northern Engineering Works, 210 Chene St., Detroit.

Insulation—Catalog. G-H Rockwool insulation materials, including wool insulation, pipe insulation, insulating cement.—Baldwin-Hill Co., 545 Klagg Ave., Trenton, N. J.

Lathes—Booklet 88. Illustrations of lathe installations.—South Bend Lathe Works, 555 Niles Ave., South Bend, Ind.

Leather Packings—Catalog A-49. Line of leather packings—sizes and prices.—Alexander Brothers, 406 North Third St., Philadelphia.

Lubrication—Folder 2-79. Ball and roller bearing greases.—E. F. Houghton & Co., Third, American and Somerset Sts., Philadelphia.

Metal Sheets—Bulletin Adv 312. Uses and advantages of "Galvannealed" sheets. Gages and sizes given.—Republic Steel Corp., Cleveland.

Meter—Bulletin 5701. "Akraflo," a fuel consumption meter.—S. F. Bowser & Co., Inc., Fort Wayne, Ind.

Piping—Catalog 38A. Repair clamps and saddles for steel and cast iron pipes. "Leak-loss" chart.—M. B. Skinner Co., South Bend, Ind.

Pipe Threaders—Form ADV-1. All-steel and malleable-alloy construction threaders.—The Ridge Tool Co., Elyria, Ohio.

Plumbing and Heating Equipment—Brochure AD1288. Illustrated 47-page booklet on the Crane Laboratories.—Crane Co., 836 South Michigan Ave., Chicago.

Pumps—Catalog B-5. Thirty-six-page illustrated description of single-suction multistage pumps.—De Laval Steam Turbine Co., Trenton, N. J.

Recorder and Controller — Bulletin E-22. The Metric-American Air-Actuated Remote Recorder and Controller.—American Meter Co., Inc., Erie, Pa.

Regulators and Meters—Bulletin. "Instructions for Ordering Regulators and Liquefied Petroleum Gas Meters" defines applications and working conditions. —Reliance Regulator Corp., Alhambra, Calif.

Reseater—Bulletin. "Standard Reseater," a set of precision tools for reseating leaky faucets, valves, and traps. —Water Service Laboratories, Inc., 423 West 126th St., New York.

Rubber Coatings — Bulletin. Announcement of the formation of a service for rubber coating metal units and supplying rubber paints. — Paramount Rubber Service, Inc., 1430 Rosedale Court, Detroit.

Rubber Hose—Data Book. Types of industrial rubber hose described; tables of recommended working pressures; frictional pressure drop and flow chart. —New York Belting & Packing Co., 1 Market St., Passaic, N. J.

Screw Conveyors—Catalog 334. Screw conveyors, parts, elevator buckets.—Chain Belt Co., 1600 West Bruce St., Milwaukee.

Sheaves—Leaflet 2333. Single-groove combination sheaves with adjustable pitch diameter.—Texrope Division, Allis-Chalmers Mfg. Co., Milwaukee.

Sling Chain — Folder. Specifications and comparative data on molybdenum alloy steel sling and coil chains.—Joseph T. Ryerson & Son, Inc., Chicago.

Small Tools—Catalog 33. Complete list of tools and shop equipment with tables and engineering data. 480 pages, index. Brown & Sharpe Mfg. Co., Providence, R. I.

Synchronizer—Pamphlet 1193. "Synchro-Operator" for automatically paralleling a.c. generators, synchronous condensers, tie lines, and frequency changers.—Allis-Chalmers Mfg. Co., Milwaukee.

Valves—Catalog, on solenoid-operated

BLACK & DECKER

World's Largest Manufacturer BLACK & DECKER **of Portable Electric Tools**

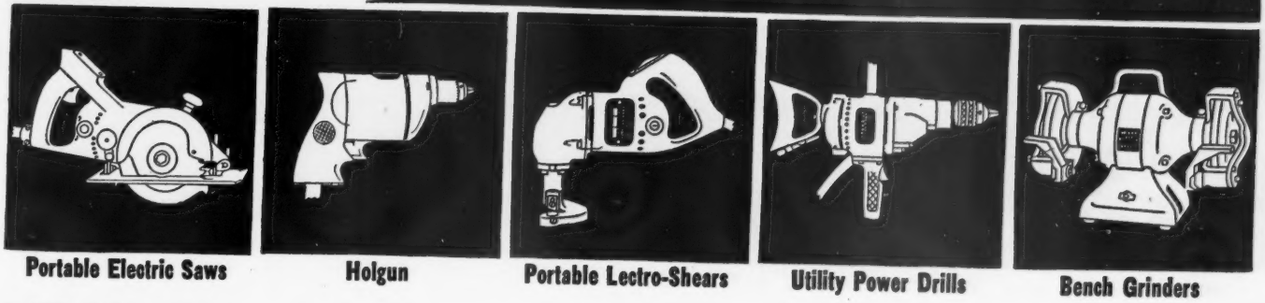
These Electric Sanders Eliminate Costly "Grind"

One of the most versatile and time-saving tools in any shop is a Black & Decker Portable Electric Sander. It makes quick, easy work of hundreds of surfacing jobs that ordinarily require slow, laborious hand filing, sanding and finishing.

Grinding welds and casting ridges; sanding, wire-brushing and polishing metal surfaces; removing rust and scale; wood surfacing and lacquer rubbing . . . . are only a few of the many jobs which these powerful, perfectly balanced tools do quicker and better.

The 7-inch Special (illustrated) together with the 7-inch Junior, for intermittent work; the 7-inch Heavy Duty for high speed production service; the 9-inch Standard, for larger working areas; and the versatile 2-speed Dual-Purpose 7″-9″ Combination Sander, comprise the well-rounded Black & Decker Sander line. In the group, there's one to fit *your* particular requirements.

Ask your Jobber about the line today, or write to The Black & Decker Mfg. Co., 719 Pennsylvania Avenue, Towson, Md.



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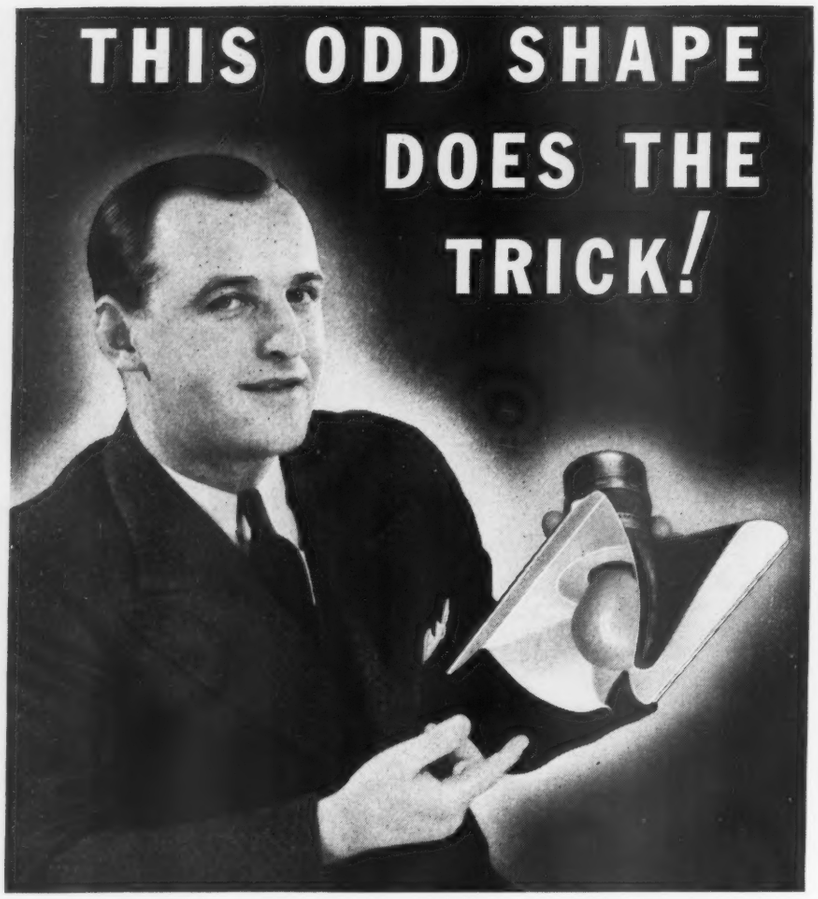

THE STOCKLITE

FOR LIGHTING SHELVES AND STOCK BINS

● **How's the light in your stockroom aisles? If you're using ordinary lighting, try this fixture and see the difference! The Stocklite properly illuminates shelves from top to bottom and also bin interiors. Note how its peculiar shape directs light to the side . . . how the curved V-shaped flanges eliminate aisle glare. The Stocklite puts an end to "spotty" illumination—provides comfortable vision everywhere in the aisle—enables stock clerks to fill orders faster and more accurately. Users everywhere are enthusiastic. It's a porcelain-enameled fixture—an exclusive Goodrich product.**

If your electrical supplier doesn't have complete information about the Goodrich Stocklite, write us for a copy of this new Bulletin No. 91, "Light on the Subject of Stock Bin Illumination."

MEMBER OF R. L. M. STANDARDS INSTITUTE

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OFFICES IN ALL PRINCIPAL CITIES

GENERAL OFFICES AND FACTORY: 2904 N. OAKLEY AVENUE, CHICAGO, ILL.

valves and automatic controlling devices.—Automatic Switch Co., 154 Grand St., New York.

Voltage Regulator—Bulletin 1194, title "Type J Rocking Contact Rheostatic Generator Voltage Regulator."—Allis-Chalmers Mfg. Co., Milwaukee.

Water Purifier—Pamphlet 1700. Hydrodarco purifier for removing tastes and odors from water.—International Filter Co., 59 East Van Buren St., Chicago.

Water Treatment—Bulletin, on Corrosan, Aquasan, Chemisan, Hytempsan, materials for preventing scale and rust.—Ferrotect Industries, 727 Varsity Road, South Orange, N. J.

BOOKS

TIMESTUDY FOR COST CONTROL

Phil Carroll, Jr., Vice-President, Dyer Engineers, Inc. McGraw-Hill Book Co., Inc., 330 West 42d St., New York. 305 pages, graphs, tables, index. $3.

Step by step outline of one practical method of completing the timestudy measurement and control of cost without rearranging the shop. As a basis for cost control, timestudy standards are taken collectively for the common denominator of comparison, thus modifying certain practices in timestudy.

GRINDING WHEELS AND THEIR USES

Johnson Heywood, under the auspices of The Grinding Wheel Manufacturers Association and The Abrasive Grain Association. The Penton Publishing Co., Penton Bldg., 1213-35 West Third St., Cleveland. 374 pages, illustrated, index. $3.

On modern grinding and polishing practice and theory. Includes chapters on internal, cylindrical, centerless, surface, roll and cam, eccentric, and other out-of-round surface grinding. Discusses polishing and buffing materials, gives wheel recommendations, and supplementary information. For shop executives, grinding machine operators, students in technical and trade schools and colleges.

ON THE CALENDAR

JANUARY

12–13, American Engineering Council, Annual Meeting, Washington, D. C. F. M. Feiker, Executive Secretary, 744 Jackson Place, N. W., Washington, D. C.

23–26, American Society of Heating & Ventilating Engineers, Annual Meeting, Pittsburgh. A. V. Hutchinson, Secretary, 51 Madison Ave., New York.

23–27, American Institute of Electrical Engineers, Winter Convention, New York. H. H. Henline, Secretary, 33 West 39th St., New York.

FEBRUARY

5–11, National Electrical Manufacturers Association, Mid-Winter Conference, New York. W. J. Donald, Managing Director, 155 East 44th St., New York.

15–17, American Management Association, Personnel and Industrial Relations Conference, New York. Alvin E. Dodd, President, 330 West 42d St., New York.

23–25, American Society of Mechanical Engineers, Spring Meeting, New Orleans. C. E. Davies, Secretary, 29 West 39th St., New York.

MARCH

7–10, American Management Association, Ninth Packaging Conference and Exposition, New York. Alvin E. Dodd, President, 330 West 42d St., New York.

DISTINGUISHED SERVICES rendered by Elwell-Parkers during 1938 in Reducing load-handling costs in Principal Industries

Machine Tool. Warner & Swasey's 50,000th Turret Lathe (see photograph) transported from Erecting Shop to Shipping Department on one of their latest Elwell-Parker Trucks, which handle an increasing volume of goods. These Trucks have been built for 33 years within 2 miles of the Warner & Swasey plant.

Steel. **(1)**—New attachment designed for use on standard Elwell-Parker Crane chassis for unique, money-saving operation during ingot production. **(2)**—Elwell-Parker Equipment was ordered for 2 of the 3 new strip mills put into operation during 1938.

Stokers. Nationally-prominent concern applies Elwell-Parker Crane to storing steel prior to fabrication. Though performing other work in addition, Crane will pay for itself on this one operation in 8 months.

Wire. World-famous producer of fasteners employs Elwell-Parker Lift Truck to unload processed wire from boxcars; to high-pile in storage; and to reclaim as required. Handling time cut 75%; useable space more than quadrupled in existing warehouse.

Paper. **(1)**—Elwell-Parker Fork Trucks pick up stout wooden pallets carrying 72" rolls of newsprint; tier 3 high (18 ft.) to warehouse roof. **(2)**—Special Elwell-Parker Truck with revolving attachment picks up heavy rolls of print stock at shipside; transports directly into warehouse, rotating each roll 90 deg.—vertical to horizontal position, or reverse—if desired. **(3)**—Elwell-Parker Crane in a large fiberboard mill builds up reserves of baled waste—unloads from road trucks and tiers to roof; then reclaims and delivers bales to beater platform. **(4)**—An Elwell-Parker with special body, dumps 5-ton batches of fiber pulp into beater.

Rubber. Analyses by Elwell-Parker Engineers of load-handling in a key plant in the "Big 4 Group" resulted in the purchase of Elwell-Parkers to handle materials, beginning with crude rubber. Important savings were immediately established and maintained.

Textiles. A major rayon project of the year transports bulky loads on Elwell-Parker Lift Truck. Man rides up with load, controlling hoist operation with push-button when high stacking.

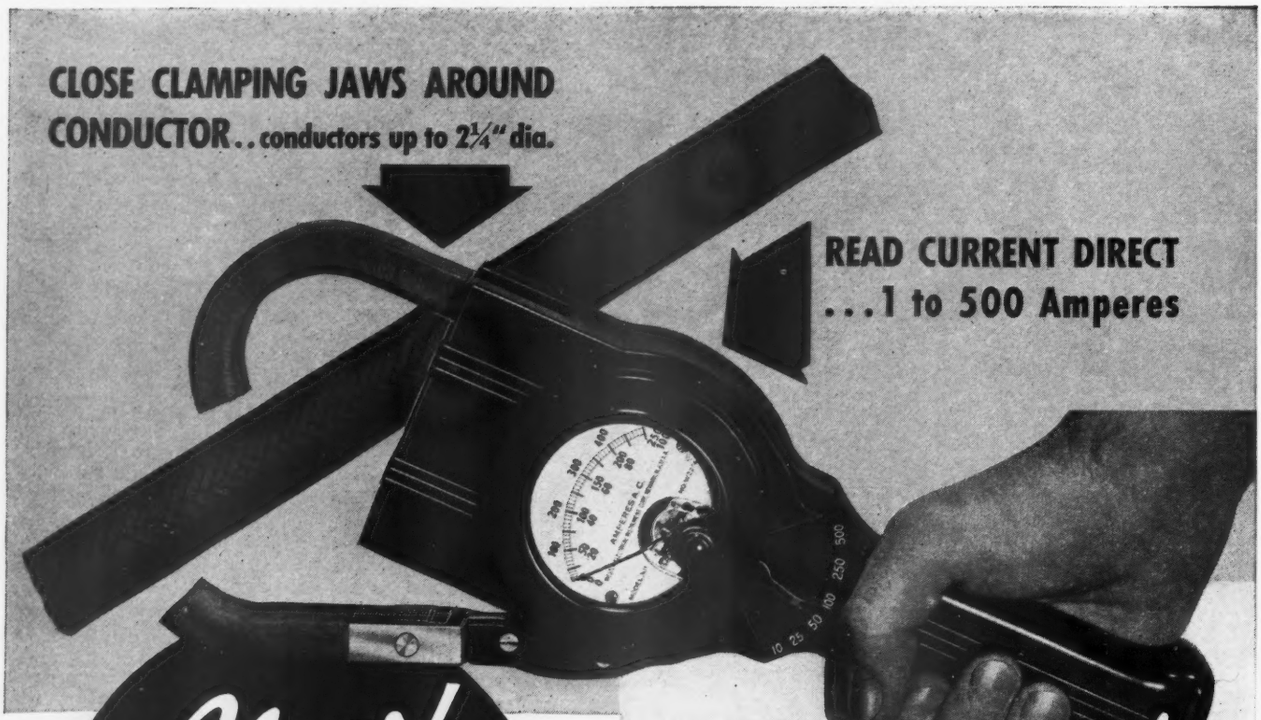
Insulation. One of America's largest corporations conveys finished units of wall insulation from processing through warehousing (tiering to roof); to loading dock and freight cars, with Elwell-Parker System.

★ ★ ★

New, ingenious, profit-saving methods of handling industrial loads without waste are developing continually from Elwell-Parker's great reserve of Engineering Experience. You need now the tangible, net reductions in manufacturing costs that an Elwell-Parker *System* can give you. Send for an Elwell-Parker Engineer—write air mail today or WIRE COLLECT. The Elwell-Parker Electric Company, 4323 St. Clair Avenue, Cleveland, Ohio.

ELWELL-PARKER *Power Industrial* TRUCKS

ESTABLISHED 1893 • BUILDING POWER INDUSTRIAL TRUCKS SINCE 1906



Now! A WESTON MULTI-RANGE CLAMP-AMMETER

Providing

BROADER UTILITY
MAXIMUM SAFETY
GREATER ECONOMY!

With *no* connections to make, *no* interruption of circuits... the self-contained WESTON Model 633 Clamp-Ammeter provides a simple, quick method of measuring AC current flow through insulated or non-insulated conductors. Remote indications, too, may be had... up to 50 feet from the clamping jaws... by plugging the quickly detachable Model 301 into a special carrying case available for the purpose. Some of the outstanding features of this new Clamp-Ammeter are described at the right. In addition, Model 633 is *attractively priced*. Complete details may be had from the WESTON representative near you, or by returning the coupon below.

6 current ranges ... 10/25/50/100/ 250 and 500 amperes

Famous WESTON Model 301 instrument . . . assures long, dependable service

For insulated or non-insulated conductors up to 2¼" diameter

Accuracy guaranteed better than 3% between 50 and 70 cycles

Sturdy bakelite case, handle and trigger . . . for maximum safety

Temperature error less than 1% from 32° to 110° Fahrenheit

Clamping jaws heavily insulated . . . protects operator . . . prevents short circuits

Man sized handle ... proper balance for easy handling

Weston Electrical Instrument Corporation,
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Send literature describing the new WESTON Clamp-Ammeter.

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Top-Quality JENKINS iron VALVES

cost no more!

VALVE BUYERS who want the best in Iron Valves turn to Jenkins and find they need pay no more than standard prices.

For the same money they can obtain top-quality—a point worth considering when buying Iron Valves. Trouble with Iron Valves isn't funny . . . means costly shut-downs, new parts, replacements. Dollars-and-cents reasons why it pays to buy the best.

In the diagram below, we cut through a Fig. 651, Jenkins Iron Body Gate Valve, high-lighting a few of its many features. Check it over, part by part. Every inch is specially designed to give the service that should be expected from every Jenkins Valve.

JENKINS BROS., 80 White Street, New York, N.Y.; Bridgeport, Conn.; Boston, Mass., Atlanta, Ga.; Philadelphia, Pa.; Chicago, Ill.; Houston, Texas; Montreal, Canada; London, Eng.

CHECK THE FEATURES OF THIS O. S. & Y. GATE

1 Handy-Grip Wheel
2 One-Piece Yoke Assembly
3 Convenient Yoke-Cap Oil Hole
4 Time-Saving Bolts
5 Long-Life Asbestos Gasket
6 Extra Strength Spindle
7 Self-Aligning Wedge Guides
8 Renewable Bronze Seat Rings
9 Six Convenient Bosses
10 Iron *Exceeds* A.S.T.M. Standards

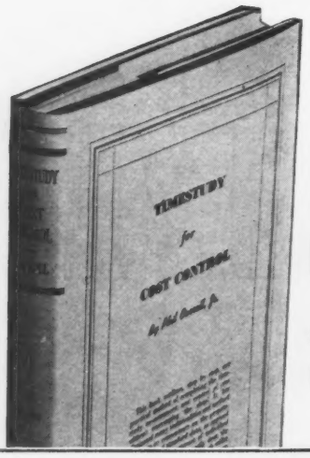
Guide to Figure Numbers of Jenkins O. S. & Y. Iron Body Gate Valves

TYPE	125 Lbs. W. S. P.		175 Lbs. W. S. P.		250 Lbs. W. S. P.	
	Scw.	Flg.	Scw.	Flg.	Scw.	Flg.
Solid Wedge . . .	650	651	277	253	204A	204
Double Disc . . .	874	875	—	—	878	879

A TYPICAL JENKINS IRON VALUE —THERE ARE 101 OTHERS!

1864 JENKINS TRADE MARK 1939

DIAMOND ANNIVERSARY



How to make timestudies and how to use them

To lower costs and improve managerial control

JUST PUBLISHED

Timestudy *for* Cost Control

By PHIL CARROLL, JR.
Vice-President, Dyer Engineers, Inc.
305 pages, illustrated, $3.00

THIS book outlines step by step one practical method of completing the timestudy measurement and control of cost without rearranging the shop. It has eliminated many technicalities and method variations to concentrate on the preparation and use of standard data, as opposed to the very costly process of individual operation timestudy. Not only does the method described permit of a much wider field of application, but the author shows wherein it logically extends beyond simple incentive to form the basis for many managerial controls.

You will want to look up in this book

—the fundamental information on the installation of timestudy for cost control;
—the description of the work involved;
—the type of personnel fitted for it, departmental organization;
—the expert information on how to make comparison sheets, how to handle setup time, how to handle variables, etc., etc.
—the application of these methods to many departments of business.

EXAMINE IT 10 DAYS—SEND THE COUPON

McGRAW-HILL ON-APPROVAL COUPON

McGRAW-HILL BOOK COMPANY, INC.
330 West 42nd Street, New York, N. Y.

Send me Carroll—Timestudy for Cost Control for 10 days' examination, on approval. In 10 days I agree to pay $3.00 plus few cents postage and delivery, or return book postpaid. (We pay postage on orders accompanied by remittance.)

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(Books sent on approval in U. S. and Canada only.)

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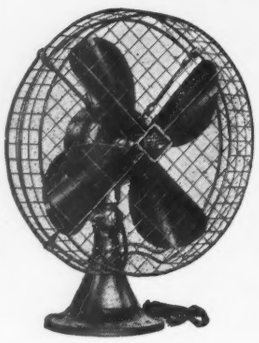
New 1939 EMERSON-ELECTRIC FAN CATALOG



New 16-inch Parker Blade Non-Oscillator with Factory-Safe Wire Mesh Guard

Send for Your PERSONAL COPY *Today!*

Save time! Save money! Whether you are checking your electric fan needs now or plan to select fans later, it will pay you to have the new 1939 Emerson-Electric Fan Catalog. Illustrations, performance data, installation facts and descriptions of all the 1939 models, in short, full information about the most complete selection of quality fans in America is yours for the asking. Don't delay. Write today for the new 1939 Emerson-Electric Fan Catalog No. 239.

You'll Want These Two Valuable Fan Buying Guides – *They're Free*

How to Select EMERSON-ELECTRIC EXHAUST Fan Equipment

Technical guide for the installation of all types of exhaust fans for the elimination of excessive heat, fumes, steam, smoke, etc. Write today for Exhaust Fan booklet, No. 240.

EMERSON-ELECTRIC Air Circulator Bulletin

A powerful air circulator for every requirement — seven models. Complete installation data. Write today for Circulator Bulletin, No. 241.

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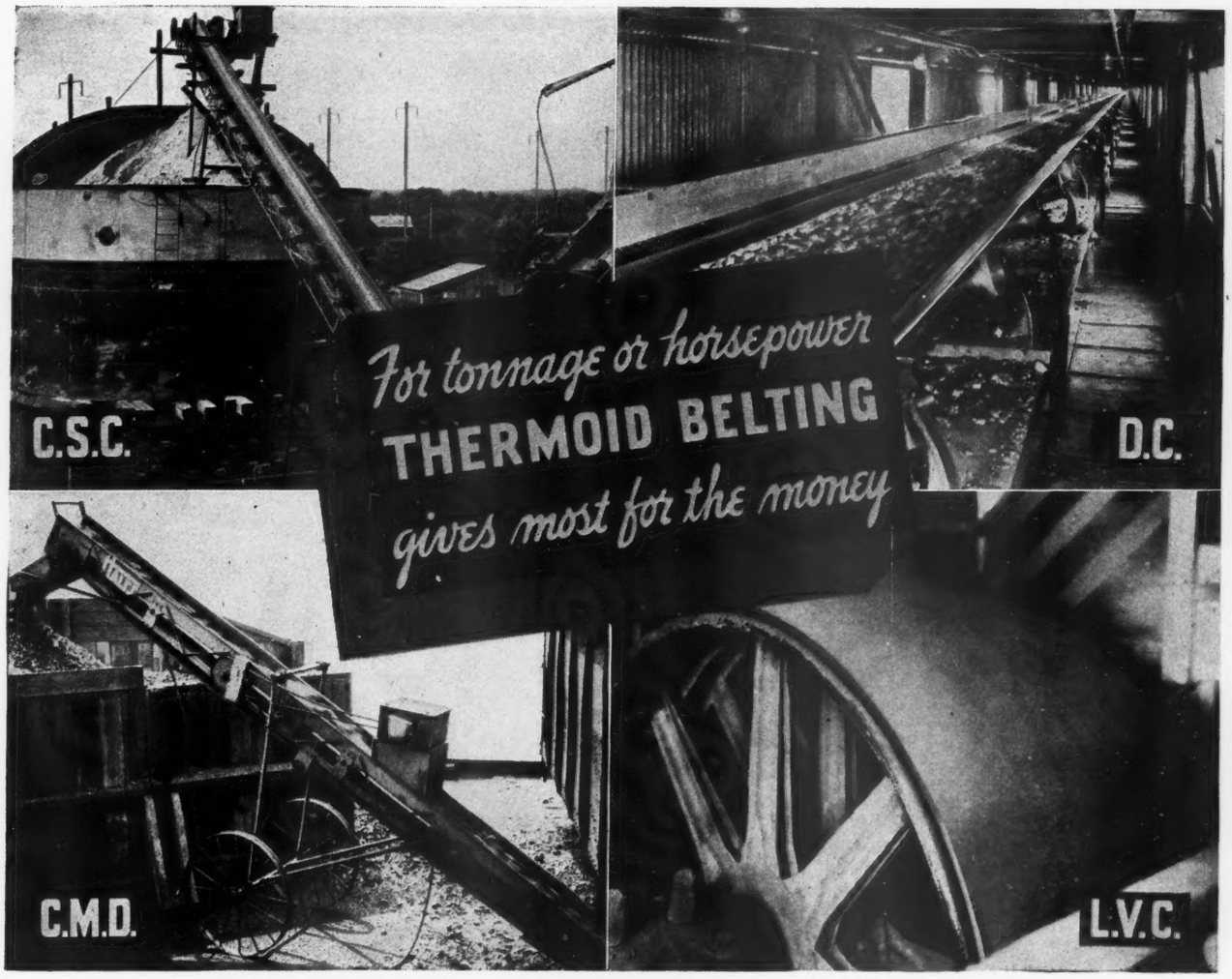

Thermoid Belting writes its record of performance on the ledgers of companies in every line of industry. When such records are combined they tell an unbroken story of top performance at lowest cost.

C.S.C. The Caton Sand Company uses Thermoid Conveyor Belting to transport sand into the storage bins. The sand is passed through a screen onto the belt which regularly carries an average of 45 to 50 tons per hour. Because of the service the belt is turning in under that load the company plans an adjustment in the agitator that will increase the hourly load to 60 tons.

C.M.D. Cramer-Meyer-Dreyer, one of New York's most modern coal plants, has many Thermoid Conveyor Belting installations. The belt illustrated is subjected to the continual abrasion of falling lumps of coal, but after two years' service still shows no sign of wear.

D.C. The Dorrance Colliery of the Lehigh Valley Coal Co., at Wilkes-Barre, Pa., uses a Thermoid Conveyor Belt that is 630 feet long and 43 inches wide. It carries hundreds of tons daily and after long service still shows practically no wear.

L.V.C. The Lehigh Valley Coal Company has an unusual transmission belting installation at their Spring Mountain Colliery. This Thermoid Transmission Belt is 100 feet long and 42 inches wide. It is ten ply for maximum possible strength, yet it is flexible. After years of service it is still in constant use, giving very satisfactory performance.

More than half a century of progressive engineering and product development.

THERMOID RUBBER, DIVISION OF THERMOID COMPANY, TRENTON, N. J.

Standard types of belting made by Thermoid:
Conveyor Belting
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Standard types of belting made by Thermoid:
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Oil Country Belting
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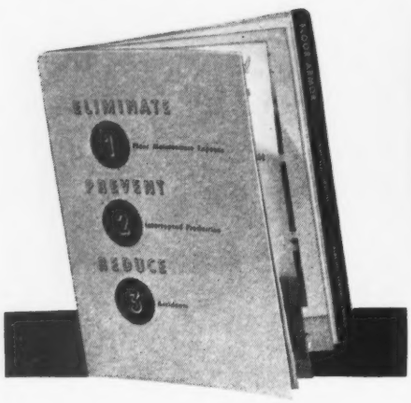
BELTING HOSE PACKINGS BRAKE LININGS

NEW!



Tells How to Solve FLOOR MAINTENANCE Problems *Economically*

This easy, economical way to avoid floor maintenance costs and troubles is fully described in the new Floorsteel file booklet. It pictorially tells how many leading companies prevent dangerous cracks and holes—and at the same time provide permanently smooth, quiet, non-skid floors by installing Acme Heavy-Duty Floorsteel.

Imbedded flush with the surface in concrete, asphalt or other suitable material, Acme Floorsteel takes the brunt of rolling loads and reduces surface wear to a minimum. The small mesh is so formed that even the smallest truck wheels will ride on three or more of the steelribs, which "mushroom" slightly and actually become stronger with use. Furnished in standard rolls in 47½", 60" and 72½" widths and 25 ft. in length, Acme Floorsteel is easily and quickly installed by your own men.

Inspect this floor armoring that adds years to the serviceable life of industrial floors.

Find out how little Acme Floorsteel costs in terms of trouble-free floor protection. Send for a copy of the new booklet. There is no obligation and it may be the means of making *big* savings.

ACME HEAVY DUTY FLOORSTEEL

MAIL THE COUPON FOR YOUR FREE COPY

ACME STEEL COMPANY
2831 Archer Ave., Chicago, Ill.

( ) Send the new Acme Floorsteel booklet

( ) Send FREE sample section of Acme Floorsteel

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Address .....

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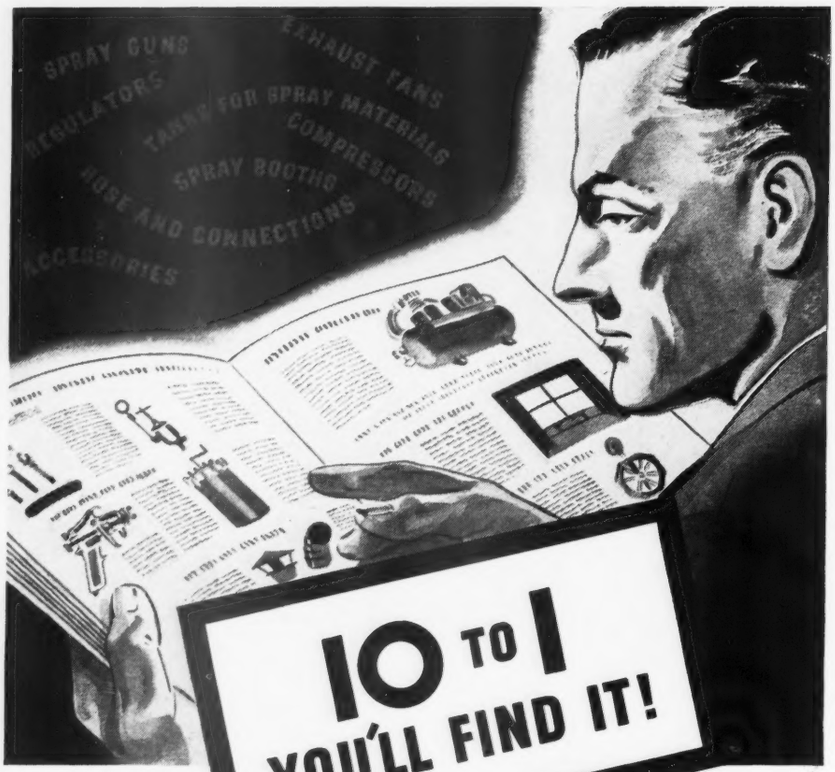

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The world's most complete line of spray equipment includes:

Spray finishing equipment

Automatic coating machines

Spray booths and exhaust fans for vapor and dust elimination

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Specialized hose for paint, air, water, gasoline, oil, welding and pneumatic tools

Hose connections

Water and Oil Guns

Paint Stripers

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For one item or a complete system
Call DeVilbiss

COUNT on DeVilbiss to solve those product finishing problems that are keeping your costs up.

Ten chances to one, there's standard DeVilbiss spray equipment that exactly fits your requirements. Because the complete DeVilbiss line includes—equipment for products of any size or shape, for any finishing material, for hundreds of different plant operating conditions—equipment for every product finishing operation from the application of the material to the ventilation of the finishing area. And each item is designed and built to improve quality and lower costs.

For that one chance that standard DeVilbiss Equipment may not fit your problem, DeVilbiss engineers will plan and produce a spray system that is "tailor-made" for profitable operation in your plant.

Take no chances! Call in the pioneers of spray painting with 50 years of spray engineering experience. Call DeVilbiss. . . There's an experienced DeVilbiss spray expert near you. . . The DeVilbiss Company, Toledo, Ohio

DEVILBISS SPRAY SYSTEMS

(*Advertisement*)

The Cost of Doing Without

Delaying a program of plant modernization may represent a costly type of temporary economy. In the case of a midwestern machinery manufacturer, the cost of doing without a modern stock storage system included an expenditure of $50,000 for unnecessary additional floor space.

By H. B. SPACKMAN

V. P. in Charge of Sales, Lyon Metal Products, Incorporated

A FEW WEEKS AGO I called at the plant of a well known midwestern machinery manufacturer for a check-up on the operation of a stockroom we had planned and equipped.

The survey upon which our recommendations were based had been made four years prior to the installation. While it had clearly disclosed possibilities for substantial time, space and inventory economies, management decided to postpone action. At the moment, "paper" savings seemed less important than the avoidance of the necessary investment in new storage equipment.

But, after a four year delay, the new equipment was installed and in full operation. And I was more than a little concerned as to how nearly its performance was measuring up to our four year old preditions. So, I asked the Works Manager for a conservative estimate on definitely established benefits.

Here are his figures:

The new stock control system had made it possible to cut the former $150,000 inventory 33⅓%.

This 33⅓% reduction in inventory, and the use of storage equipment that made it possible to consolidate storage in a central stockroom had released for manufacturing purposes 7,000 square feet of floor space, worth approximately 75 cents per foot . . . or $5,250.00.

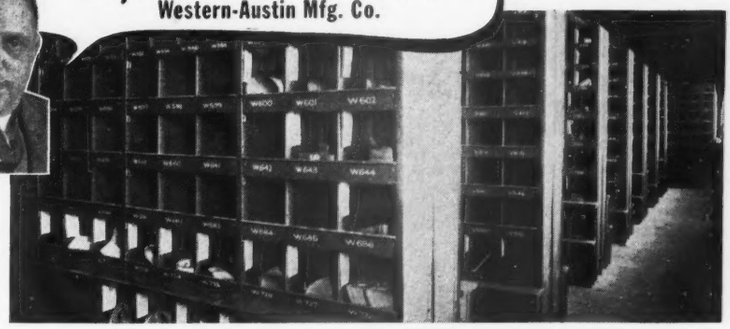
A $50,000 reduction in inventory and a floor space saving of $5,250.00 are, most executives will agree, not the kind of economies to be postponed year after year. But this wasn't the whole story.

"If," the Works Manager continued, "this system had been put into effect immediately after the survey, we could have avoided a $50,000 investment in an addition to our plant."

The frame of mind which caused this manufacturer to spend thousands of dollars for *doing without* modern storage equipment is not unusual. Until such equipment is in operation, it is really difficult to appreciate how effectively it conserves time, reduces inventory requirements, and releases floor space for manufacturing purposes. On the other hand, any executive who will investigate the benefits gained by nearly every type of industrial and commercial organization through a survey of storage facilities and stock control methods is likely to decide that similar action should be one of his "must" jobs for 1939.

"OUR LYON STEEL SHELVING *Effects* IMPORTANT ECONOMIES"...

Says **Mr. Jack Owens, Purchasing Agent, Western-Austin Mfg. Co.**



● "Four definite reasons explain our decision to standardize on Lyon Steel Shelving," continues Mr. Owen. "(1) First cost is the last cost; (2) It saves time and floor space; (3) Its complete flexibility enables us to meet constant changes in sizes and quantities of parts stocked; (4) Time, hard usage and frequent rearrangement do not impair its ship-shape appearance. Our Harvey plant was equipped with Lyon Steel Shelving in 1931. Two additions since that time have been made at low cost . . . and without interruption to production schedules."

It costs you nothing to have an experienced Lyon representative help you survey your plant for possible economies through space conservation, product protection, service acceleration, or inventory reduction. His job is to help you get the facts. Your judgment alone determines subsequent action.

LYON METAL PRODUCTS, INCORPORATED
AURORA, ILLINOIS

LYON STORAGE EQUIPMENT *Service*
LYON METAL PRODUCTS, INCORPORATED, Aurora, Illinois

Lyon Metal Products, Incorporated
1201 River St., Aurora, Ill.

Please send full particulars on your no-cost, no-obligation check up on storage and materials handling methods.

Name_____

Address_____

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The new LIFTABOUT ELECTRIC HOIST

CAPACITIES ONE-EIGHTH TO TWENTY TONS

OUTSTANDING FEATURES

"Balanced Drive" Heat-Treated Gearing
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have made the new *LiftAbout the most widely used electric hoist in American Industries.*

WRITE FOR BULLETIN No. 126

NEW ANTIFRICTION BEARING LIFTABOUT OPERATING WITH A SHEPARD NILES SINGLE I-BEAM CRANE

SHEPARD NILES CRANE & HOIST CORP.

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New

A MILLION SPEEDS AT YOUR FINGER TIPS!!

IDEAL "SELECT-O-SPEED" TRANSMISSION

Inexpensive

Gives an infinite selection of speeds through a 5-to-1 range. For use on all types of machine tools, stokers, conveyor belts, etc.—wherever variable speeds are necessary or desirable. Uses standard "V" belts.—No expensive up-keep.

Cuts down spoilage — increases production. *"Select-O-Speed"* modernizes old equipment.

Comes as a packaged unit ready to set in place—installed on floor, ceiling, wall or right on machine—AS EASY TO INSTALL AS A "V" BELT DRIVE.

Write for complete information

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IN HUNTING FOR AIR LEAKS YOU OFTEN FIND

GOLD

You can lower your costs of handling air, by avoiding the common pitfalls that are frequently present in both old and new systems. Finding these "leaks" is like finding real money. The Free Booklet "AIR - TIGHT" gives you 10 simple methods to track down all air leaks. Send for your copy.

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Blow Guns Spray Guns
Quick-Acting Couplers
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Air "Knock-Out" Sets
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Catalog sent upon request.

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Division of Scovill Manufacturing Company, Incorporated

Workers Prefer it—
Economy Demands it

"A. W." Rolled Steel Floor Plate serves the interests of both men and management by making floors *permanently* safe. Dangers encountered with ordinary flooring are entirely eliminated. Men and equipment move safely and swiftly. There is no maintenance expense because toughest traffic will not damage or impair it. "A.W." Floor Plate can be cut to any shape and installed *almost over-night*—that isn't a catch phrase; it's a fact. Rain drains off at once. Snow and ice lose most of their threat. Cleans easily. Oil-proof, heat-proof, crack-proof. Find out how little "A.W." Rolled Steel Floor Plate costs in terms of trouble-free floor protection. Literature showing five patterns and giving complete engineering data is ready for your asking. Write for it today.

"A.W." *Rolled Steel* FLOOR PLATE

ALAN WOOD STEEL COMPANY

MAIN OFFICE AND MILLS, CONSHOHOCKEN, PENNA. : : SINCE 1826 : : DISTRICT OFFICES AND REPRESENTATIVES—Philadelphia, New York, Boston, Detroit, Chicago, Los Angeles, Seattle, San Francisco, Houston, Roanoke, Buffalo, Pittsburgh, Cleveland, Cincinnati, New Orleans, St. Paul, St. Louis, Montreal. PRODUCTS INCLUDE—"A. W." Rolled Steel Floor Plate : : "Swede" Pig Iron : : Billets—Blooms and Slabs : : Sheared Steel Plates : : Hot Rolled Sheets and Strip : : Steel Products also furnished in Copper and Alloy analyses.

THE UNBEATABLE COMBINATION

INDUSTRIAL BROWNHOIST

GENERAL OFFICES: BAY CITY, MICHIGAN

DISTRICT OFFICES

New York, Philadelphia, Pittsburgh, Cleveland, Chicago, Agents in Other Principal Cities

Industrial Brownhoist and Diesel Power

Crane owners who think they are money ahead by "getting along" with their present equipment just aren't familiar with the new Industrial Brownhoist models. Here are a few facts about them worth considering.

The new Industrial Brownhoist Diesel cranes are more ruggedly built and are averaging 20% bigger output per day at a saving of 20% to 40% in fuel costs over the cranes they replaced. The Diesel, moreover, is one-man operated and has more speed and power for switching service than most plants ever require.

With business looking up and more work to do, now is a good time to bring down handling costs. Compare your present figures with those of some Industrial Brownhoist Diesel owners who are using their cranes for work similar to yours. We will be glad to give you this data and complete information on the right size crane for your plant.

for Results

USE

McGRAW-HILL DIRECT MAIL LISTS

As business paper publishers for over fifty years, McGraw-Hill is uniquely equipped to offer complete, authoritative direct mail coverage of Industry's major markets. Extreme accuracy is maintained (guaranteed to 98%) and through careful analysis of markets, complete classification of companies and personnel, etc., the widest possible selections are available. Send for handy reference folder "Hundreds of Thousands of Reasons Why" which describes how McGraw-Hill Lists are built and maintained.

• What Fields Do You Want to Reach? •

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For further details, selections from above basic classifications, counts, prices, etc., or estimates on special lists . . . ask any representative or write to

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. . . Complete lists covering industry's major markets

POWER PIPING jobs of *J & L Seamless* give you longer service... are safer... more dependable... because *J & L Seamless* can take it

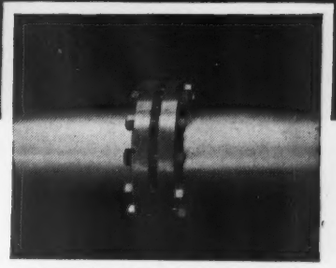
There's extra strength in every length of J & L Seamless Pipe —strength that assures safety, long life and greater operating efficiency.

J & L Seamless Pipe has no weak spots where ruptures can occur. It is pieced from a solid billet, then expanded and rolled to final dimensions. There are no welds... therefore no chance of a failure occurring at or near a weld.

J & L Seamless Pipe offers maximum resistance to corrosion . . . heat and high pressure. Because of the special selected steel used in its manufacture, J & L Seamless Pipe is easy to bend and coil. When faced with complicated upsetting and machining jobs, pressure joint manufacturers like the excellent working qualities of J & L Seamless for they get better joints that assure trouble-free installation and that give long years of service and complete customer satisfaction.

Installations in power and processing plants throughout the country are proving the safety, economy and efficiency of J & L Seamless Pipe.

Make your maintenance dollars go farther. Specify J & L Seamless Power Piping for both new installations and replacement work.



J & L Seamless Pipe is ductile, for easy bending, coiling and upsetting . . . strong, for safety and long life.

Write for this J & L Tubular Pipe Handbook —SP-4, on your business letterhead. It contains valuable application data, including a steam flow chart, that will help you.

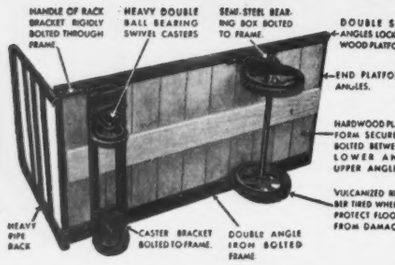
JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS
PITTSBURGH, PENNSYLVANIA

MAKERS OF HIGH QUALITY IRON AND STEEL PRODUCTS SINCE 1850

J & L—ALWAYS MAKING FINER CARBON STEEL PRODUCTS FOR NEW AND BETTER USES

THEY GIVE YEARS MORE SERVICE


HANDLE OF RACK BRACKET RIGIDLY BOLTED THROUGH FRAME.
HEAVY DOUBLE BALL BEARING SWIVEL CASTERS
SEMI-STEEL BEARING BOX BOLTED TO FRAME.
DOUBLE SIDE ANGLES LOCKING WOOD PLATFORM.
END PLATFORM ANGLES.
HARDWOOD PLATFORM SECURELY BOLTED BETWEEN LOWER AND UPPER ANGLES.
VULCANIZED RUBBER TIRED WHEELS PROTECT FLOORS FROM DAMAGE.
HEAVY PIPE RACK
CASTER BRACKET BOLTED TO FRAME.
DOUBLE ANGLE IRON BOLTED FRAME

Just look at the rugged construction of these Fairbanks "Commander" steel-frame platform trucks with hardwood platform. Is it any wonder that they last years longer!

Note the way they're armored. Heavy steel angle irons protect the hardwood platform from bumps. They are built to take the most brutal punishment without injury.

Pipe handles and racks are held rigidly to frame by bolts, and can be removed at will. The platform, too, can be replaced, in case of accident, without cutting or rewelding frame or understructure.

Write for our Catalog No. 52

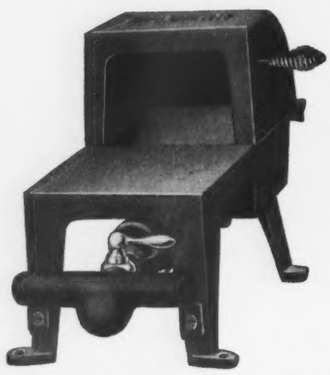
THE FAIRBANKS COMPANY

401 Lafayette St. New York, N. Y.

Boston, Pittsburgh — Distributors in Principal Cities

Fairbanks
PLATFORM TRUCKS

JOHNSON No. 501 SOLDERING FURNACE GIVES HIGH HEAT WITHOUT BLOWER



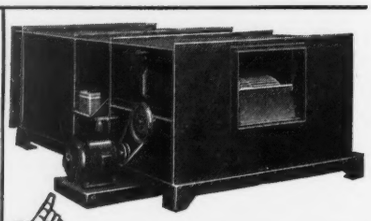
Do many jobs well at low cost with the No. 501. Famous Johnson Direct Jet Bunsen Burner burns any kind of gas hot and clean, without requiring blower or forced air. Curved hood returns flame-blast over work, or may be removed if desired. Handles soldering coppers up to 6 lbs. per pair. Firebrick base. Does efficient heat-treating of carbon steel tools and parts. Many cost-cutting features. Write for free catalog today.

JOHNSON GAS APPLIANCE CO.
Cedar Rapids IOWA

CUTTING COSTS in AIR CONDITIONING

To install Clarage air conditioning equipment is to be certain of satisfactory results at low cost. Clarage products are expertly designed—highly efficient—sturdily built—carefully tested. If you have ANY "air" problem, Clarage engineers can help you. Write us for any desired information.

MULTITHERM UNITS



New self-contained, cabinet type conditioning units that **fit into small space** — either suspended from the ceiling, or mounted on a platform or the floor. **Easily installed.**

Built in proper sizes and arrangements for simple cooling jobs or complete year 'round conditioning. Cooling medium can be cold water or direct expansion refrigerant. Temperature and humidity accurately controlled.

Ideal for Conditioning Industrial Departments, Offices, Laboratories, etc.

AIR WASHERS

Built in standard types and sizes to meet practically any industrial or commercial air cleaning or conditioning requirement. Unique nozzle design and parallel flow eliminators promote **low operating costs. Easily erected.** Also special air washers for unusual process applications.

UNICOILS

Used in small central station conditioning plants, saving time and money in installation by combining **all necessary heat transfer elements in one structure.**

Each unit consists of finned-copper coils, eliminators, galvanized casing with settling tank, and inspection door. Filters can be added. Wide range of sizes.

FANS

Broad line covering every conceivable fan application—air conditioning, ventilating, exhausting, mechanical draft, etc. Various arrangements to meet drive conditions.

TYPE W FAN (shown above) — High speed with full self-limiting horsepower characteristic—efficient performance. **Particularly suited to direct motor drive.** Quiet operation.

VORTEX CONTROL

Patented device which controls fan capacity **without resorting to expensive variable speed drive.** Built into fan inlet as shown below. Any Clarage fan can be equipped. The most satisfactory and economical method of controlling air volumes to meet varying load demands.

SPECIFY CLARAGE
for
COMPLETE AIR CONDITIONING
•
VENTILATION
•
HEATING
•
COOLING
•
MECHANICAL DRAFT
•
FANS & BLOWERS FOR INDUSTRIAL NEEDS

CLARAGE FAN COMPANY • Kalamazoo, Mich.
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

What do they think of *your* Industry... of *your* Firm?

McGraw-Hill's new Editorial Program points the way to better understanding between your company and its workers, customers, and community

THE VERY FUTURE of your business may depend on what "they" think of your firm—on what impression it is making on its workers, customers, and community. In order to help business leaders in the complex problems of dealing with their "publics" the McGraw-Hill Publications launched in October a concentrated editorial program on *Public Relations*.

Each McGraw-Hill publication will present from now on a complete program, based on the general McGraw-Hill public relations plan . . . but *tailor-made to fit its own segment of industry*.

The McGraw-Hill publication edited for your needs will continue to report the news from the industrial front on products, machinery, markets, and methods . . . but in addition it will supply specific material on dealing with *your* workers, *your* customers, and *your* community—successfully.

Since the opening of this concerted Public Relations Program in McGraw-Hill Publications, a most gratifying response has been recorded. Thousands of reprints have been ordered, and commendatory letters have been received from hosts of readers. Here are a few significant excerpts from typical letters.

"I am very glad to note that you are going to make a special effort to bring American business before the public in a little better light."
H. T. Dyett, *President*
Rome Cable Corp.
Rome, N. Y.

"I am certain the articles presenting the various problems of the aviation industry will aid materially in increasing public interest."
Paul H. Brattain, *V. P.*
Eastern Air Lines, Inc.
New York, N. Y.

"We appreciate your treatment of this subject in your October 8th issue and are studying it with a great deal of interest."
F. A. Coffin, *V. P. & Sales Mgr., Wisconsin Electric Power Co.*
Milwaukee, Wisc.

"Local group already organized to tell story of industry to citizens of Worcester . . . the chairman of this committee told me that he expects the McGraw-Hill public relations program will be a great help to him in carrying on the local work."
A. C. Higgins, *Pres.*
Norton Company
Worcester, Mass.

"Am sure anyone getting the American Machinist and reading this insert will be greatly benefited... am having it sent to quite a number of our executives."
B. B. Quillen, *Pres.*
Cincinnati Planer Co.
Cincinnati, Ohio

"You and your associates deserve the congratulations and the gratitude of the entire industry for having prepared what, in my opinion, is the most complete and comprehensive statement of a sound and constructive public relations program for our industry, that I have ever seen. You have approached the entire subject from a very practical point of view, eliminating all the ballyhoo and the window dressing with which so many public relations efforts are all too frequently burdened . . ."
T. M. Forbes, *Sec'y*
Cotton Mfg. Assn.
of Georgia

"I shall take it upon myself to see that the officials of the Company connected with my Department read this section and shall also call the attention of the members of our Scale Committee to the October Issue of Coal Age . . ."
L. E. Young, *V. P.*
Pittsburgh Coal Co.
Pittsburgh, Pa.

In order that you, your firm, and your industry may also profit from this new program, we will send you a free sample copy of the McGraw-Hill publication specifically edited for your needs.

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McGRAW-HILL PUBLISHING COMPANY
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YOU NEVER HIRED HIM— BUT HE'S ON YOUR PAYROLL

The "Dust Hog" in your plant is first in line to get your money. Only you never see him. Because the "Dust Hog" never collects under his own name. He is too smart for that, too subtle, too patient.

He gets "his" casually . . . every hour of every day. As "Wear and Tear" . . . as "Spoilage" . . . as "Corrosion" . . . as "Cleaning Expense", he takes hundreds of dollars from your plant . . . and your's . . . and your's.

He's the hardest worker on your payroll—he's everywhere, always busy.

But he's working AGAINST YOU!

CONTROL THE "DUST HOG"!

Write for DUST CONTROL LITERATURE

PANGBORN

THE WORLD'S LARGEST MANUFACTURER OF DUST CONTROL AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION · HAGERSTOWN, MD.

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FROM PLANT TO OFFICE . . .

. . . VEEDER-ROOT'S Magnetic Counters

These counters will flash accurate reports on production and performance *to your office from the next town,* if need be. In fact, they can be centrally group at *any distance* from the machines or processes to which they are connected by mechanical contacts.

Installation and connection are quick and easy. Counters may be hooked up to dry cells, storage batteries, or regular lighting circuit. WRITE FOR CATALOG G-39.

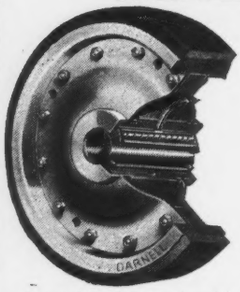
Offices in Boston, Chicago, Cincinnati, Cleveland, Detroit, Greenville, S. C., Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Montreal, Canada, Buenos Aires, Mexico City, London, Paris, Tokio, Shanghai, Melbourne

VEEDER-ROOT INC. HARTFORD, CONN.

Step Up **SPEED** *with EASY ROLLING*

DARNELL

CASTERS & WHEELS



Darnell Wheels offer a long life of efficient service with increased satisfaction in savings effected.

Increased employee efficiency is but one of the many advantages that Darnell Products offer. Any Darnell distributor will gladly give you proofs of substantial savings in equipment and floor maintenance costs, as well as many other economies their installation brings you. Write for new 192 page Darnell Caster and Wheel Manual.

DARNELL CORPORATION, LTD.

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36 N. Clinton St., Chicago • 2% E. 22nd St., New York

On All Types of O. D. Grinding

The Norton "B-E" Wheel Is Breaking Records

FAST "spark out"—that's the result you can expect from the Norton "B-E" bonded O. D. grinding wheels. Try these fast cutting wheels on your centerless and cylindrical grinding operations. The patented "B-E" bond is an exclusive Norton development.

NORTON COMPANY, WORCESTER, MASS.

W-679

3 ARE LESS TROUBLE THAN 10!

THESE 3 Eagle BEARING METALS MEET MOST BEARING METAL REQUIREMENTS

(sold through recognized jobbers)

EAGLE DREADNAUGHT

For extreme speed and pressure conditions.

EAGLE OUTLASTA

For medium speed and pressure conditions.

EAGLE DURABLE

For low speed and pressure conditions.

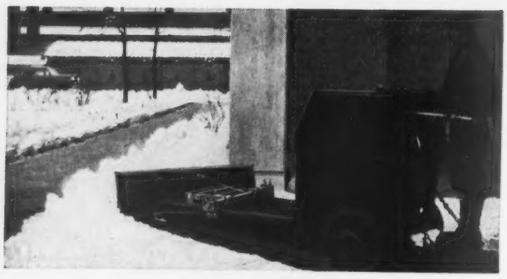
THE EAGLE EP PICHER EAGLE-PICHER LEAD COMPANY
CINCINNATI, OHIO

Avoid Costly Shutdowns by using scientifically formulated bearing metals. Eagle Bearing Metals are alloyed under carefully **CONTROLLED SPECIFICATIONS.** Casting temperatures are maintained exactly to secure the proper crystalline structure for long life. Eagle Bearing Metals contain no hard spots to cut and score the shaft. The use of only clean primary metals and the scientific control of the entire alloying process assure a uniformity in Eagle Bearing Metals which can only be attained by such means.

MAIL THIS COUPON TODAY FOR FACTS

Silver Blade

A plow for low cost snow removal. Attach in a few minutes to platform of any power lift-truck.



There's plenty of heavy winter ahead! Every snowfall will bring new hazards and unnecessary expense to your plant unless you are equipped to remove snow quickly and at low cost. Factory readers who have not yet investigated SILVER BLADE for walks, yards, runways, piers and docks are invited to rush the coupon below for complete information.

EASTON CAR & CONSTRUCTION CO., EASTON, PA.:
Please send fully illustrated folder describing the SILVER BLADE SNOW PLOW.

Name.....

Company.....

Address.....

City.....State.....

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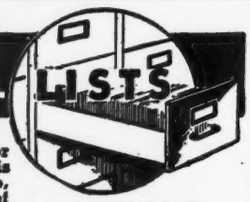

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Bus & Electric Railways
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Process Industries
Textile Industries

Administrative Executives
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Mill Supply Houses
Power Services
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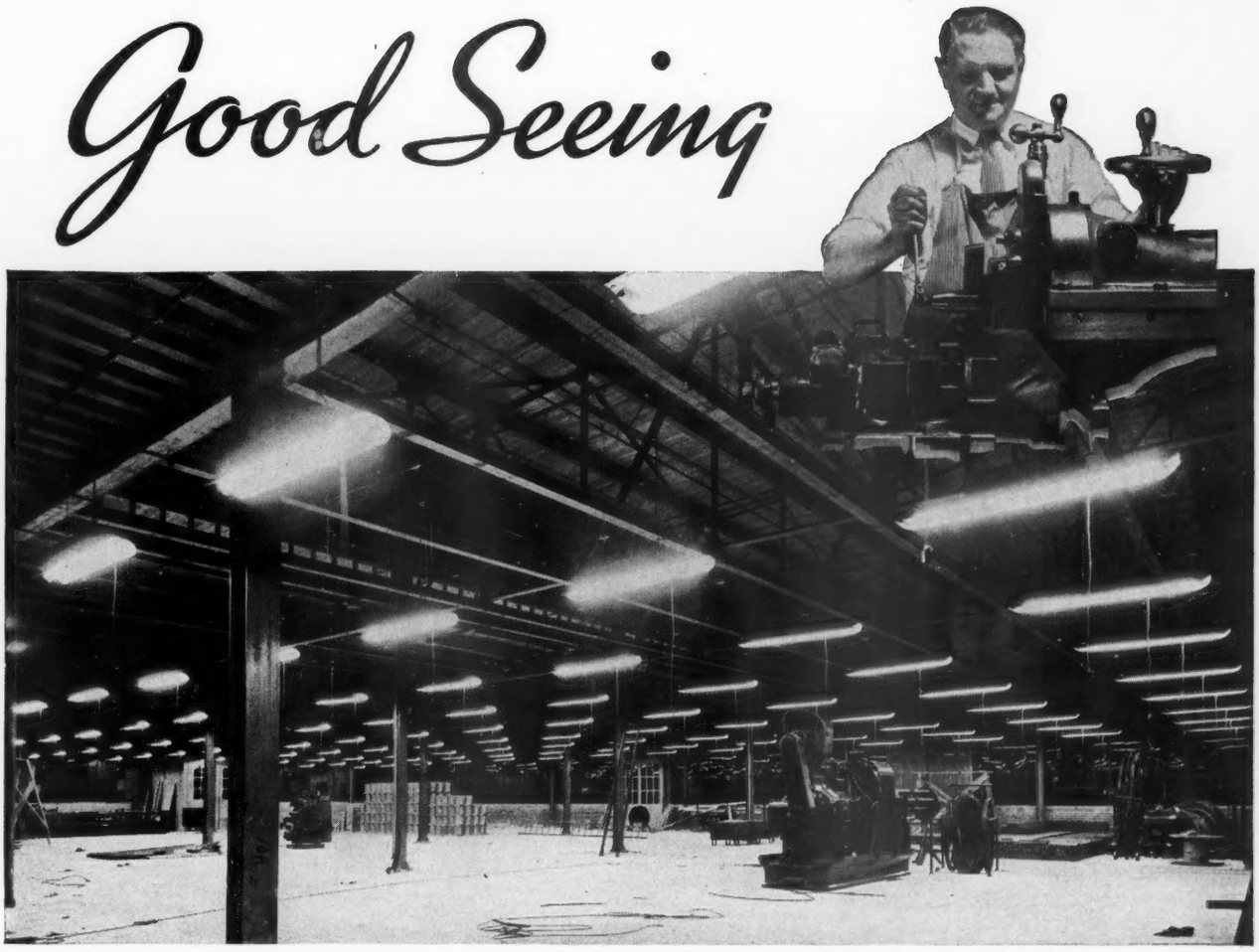
. . . Complete lists covering industry's major markets

Good Seeing



. . . is the vital link between good workmen and good work

With long tube Mercury Lamps engineered to fit the job industry is forming the vital link that assures good work from good workmen. Today this modern light rates on a par with machine tools, conveyors, and control equipment as a fundamental in production efficiency. Management and workmen both realize that human eyes are industry's most critical control device. » » » Cooper Hewitts, engineered to fit the job, virtually eliminate shadows. The long tube light sources are naturally low in glare factor. There are no eye-straining reflections from bright metal parts. High illumination levels that promote good seeing and good work can be achieved with safety and comfort. Our lighting specialists will gladly discuss the profit possibilities with you of "tooling up" with this modern detail-revealing light. » » » For complete information write to General Electric Vapor Lamp Co., 815 Adams Street, Hoboken, N. J.

GENERAL ELECTRIC VAPOR LAMP COMPANY

923C

COOPER HEWITT MERCURY VAPOR LIGHT

WHERE TO BUY

SUPPLEMENT

Featuring additional products and specialties for manufacturing plants

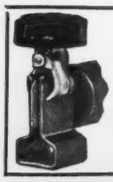
TRICO

FUSES

ARE DIFFERENT.
That famous *"powder-packed"* renewal element adds so much in safety, efficiency, and dependability—and at NO EXTRA COST.

Try Trico Today!

TRICO FUSE MFG. CO. Milwaukee, Wis.



TRICO KLIPLOK CLAMPS FOR FUSE CLIPS

The moment you install KLIPLOKS, you eliminate burnt fuses, premature blowings, and wasted power. They correct bad clips—they protect new clips.

Trico Fuse Mfg. Co., Milwaukee, Wis.

TRICO FUSE PULLERS

Eliminate the dangers of shocks, burns, infections, etc. Equip every fuse box and switchboard with TRICO Fuse Pullers. Do it today!

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LOWER HANDLING COSTS!

LEWIS CONTAINERS

Skid Boxes - Box Trucks
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Dept. X1 Watertown, Wis.

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If so, how many plants represented by the thousands of readers of Factory Management and Maintenance could use it too (and would BUY it) if your advertisement appeared here?

THE NEW PATENT STOPWATCH!

Guaranteed against breakage and wear. FREE TRIAL! Send for catalog today.

Repair Specialists, All Makes
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TRICO OILERS

These oilers maintain a constant level of oil in bearings, gear boxes, line shafts, etc. One filling lasts six to 12 months. Oil supply always visible. Try some—you'll like them.

TRICO FUSE MFG. CO.
Milwaukee, Wis.

THE PURE OIL COMPANY

PURE THREE POINT LUBRICATION

THE PURE OIL PURE COMPANY, U.S.A. — THREE POINT SERVICE — INDUSTRIAL DEPT. APPLICATION ENGINEERING — CRUDE

A COMPLETE LINE OF INDUSTRIAL PETROLEUM PRODUCTS

OIL CO.

CHICAGO, U.S.A.

INDUSTRIAL CONSULTANTS

ASSOCIATED ENGINEERS, INC.

Management Consultants
Engineering—Accounting
Organization—Methods—Costs

Old-First Bank Building, Fort Wayne, Indiana

OLIVER FIELD ALLEN

Licensed Professional Engineer, New York State
Fellow: A.I.E.E. Member: A.S.M.E. S.A.E. Am. Chem. Soc., Soc. Am. Mil. Engrs.
Consulting Engineer
Diesel Engines, International Engineering Liaison. Gas and Oil Engine Power Applications. Regular Foreign Correspondents
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The Trend Toward Economy—

The service of the consulting engineer is a real economy. With his knowledge of organization and production problems and his wide and varied experience, he can usually reveal the points of waste and inefficiency that are costing you money and suggest inexpensive means for their elimination.

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MOTION AND TIME STUDY — INDUSTRIAL MANAGEMENT
INSTRUCTION — CONSULTATIONS
TRAINING — INSTALLATIONS

Wood and Franklin Streets, Station 21
Pittsburgh, Pa.

ALLAN H. MOGENSEN

Training in Work Simplification

330 W. 42nd Street
NEW YORK CITY

The most widely used Filter for Central System Air Conditioning Service!

COMPACT DESIGN

HIGH CLEANING EFFICIENCY

CONVENIENT INEXPENSIVE MAINTENANCE

A TYPICAL AIRMAT PL-24 INSTALLATION

THE three outstanding features of the Airmat PL-24 Filter—Compact Design, High Cleaning Efficiency, and Convenient Inexpensive Maintenance—have made it the outstanding choice of ventilating and air conditioning engineers. It requires no more space than an ordinary viscous filter but because of its unique loading principle provides 30 square feet of filter surface area. The filter media is the patented Airmat paper furnished in 225 ft. rolls which may be applied with either a mechanical or manual loader.

Airmat PL-24 Filters are ideal for general ventilation and commercial and industrial air-conditioning systems where highest efficiency and easy maintenance count. Write for Bulletin No. 230A.

AMERICAN AIR FILTER COMPANY, INC.

Incorporated

114 Central Ave., Louisville, Ky.

In Canada: Darling Bros., Ltd., Montreal, P. Q.

AMERICAN AIR FILTERS

POSITION VACANT

INDUSTRIAL ENGINEER WANTED to qualify as assistant superintendent with knowledge of paper fabricating and printing. Familiar with modern production methods, standard time analysis, etc. Give full details including age, education, experience, and salary. P-533, Factory Management and Maintenance, 520 N. Michigan Ave., Chicago, Ill.

EMPLOYMENT SERVICE

EXECUTIVES AND TECHNICAL MEN: Contact employees for positions through our confidential and effective methods. We negotiate preliminary overtures. Established 24 years. Inquiries invited. H. H. Harrison, Director, The National Business Bourse, 20 West Jackson Blvd., Chicago.

WE ARE placing exceptional executives and technical men. Heavy demand for above average men at good salaries. Interviews arranged. All dealings strictly confidential and pleasant. Inquiries invited. Molene Personnel, Bankers Building, 105 W. Adams St., Chicago.

POSITIONS WANTED

WORKS ENGINEER OR ASSISTANT, can take charge of department, widely experienced in auto, rubber, steel and base-metal industries, design, construction, purchasing of plants, machines and equipment, plant layouts and process studies, production planning, operation and maintenance; age 44, technical and business training, self-starter, efficiency minded, and thoroughly dependable, seeks permanent connection with progressive firm. PW 530, Factory Management and Maintenance, 520 N. Michigan Ave., Chicago, Ill.

INDUSTRIAL ENGINEER: Age 37, 12 years' experience in equipment design, processing, and manufacturing. Exceptional knowledge of plant layout and time study in connection with conveying equipment. Executive position desired. PW 531 Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

INDUSTRIAL ENGINEER. Sixteen years intense tactful industrial experience private and consulting. Costs, Wage Incentives, Production Planning, Layout, Processes, Budgetary Control, Cost Reduction Methods, etc. Skilled in Personnel Relations. Excellent record of accomplishments. Present assignment about completed. PW-532, Factory Management & Maintenance, 330 W. 42nd St., New York, N. Y.

BUSINESS OPPORTUNITY

Floor Scrubbing Machine

Home and commercial. Offered on royalty basis to reliable manufacturer. Jos. S. Benish, 120-6 Avenue N., Wausau, Wisc.

WANTED

ANYTHING within reason that is wanted in the field served by Factory Management & Maintenance can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

SEARCHLIGHT SECTION

EMPLOYMENT BUSINESS **"OPPORTUNITIES"** EQUIPMENT USED OR SPECIAL

UNDISPLAYED—RATE PER WORD

Positions Vacant and other classifications—15 cents a word, minimum charge $3.00 an insertion. Allow 10 words for box address. No additional charge for forwarding replies.
Positions Wanted (full or part-time salaried employment only), ½ the above rates.
Discount of 10% for payment in advance on 4 consecutive insertions of undisplayed advertisements.
Proposals—50 cents a line.

DISPLAYED—RATE PER INCH:

The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.
COPY FOR NEW ADVERTISEMENTS RECEIVED UNTIL THE 18TH OF THE MONTH FOR THE ISSUE OUT THE FOLLOWING MONTH. (F.M.M.)

—TRANSFORMERS—

A Complete Stock **Prompt Shipment**

SPECIAL. 2—450 KVA Pittsburgh Transformers, 3-phase 60 cycle, 12000–230/460 volts **$735.00** Each

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Write for Catalog No. 133-D

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

McBRIDE & McCLENNEN

Trading as

DELTA EQUIPMENT CO.

Machine Tools — Boilers
Air Compressors — Electric Motors
Engine Generators — Pumps
Electric Motors

Cut Costs by Saving Thru Us.

148 N. 3rd St. Philadelphia, Pa.

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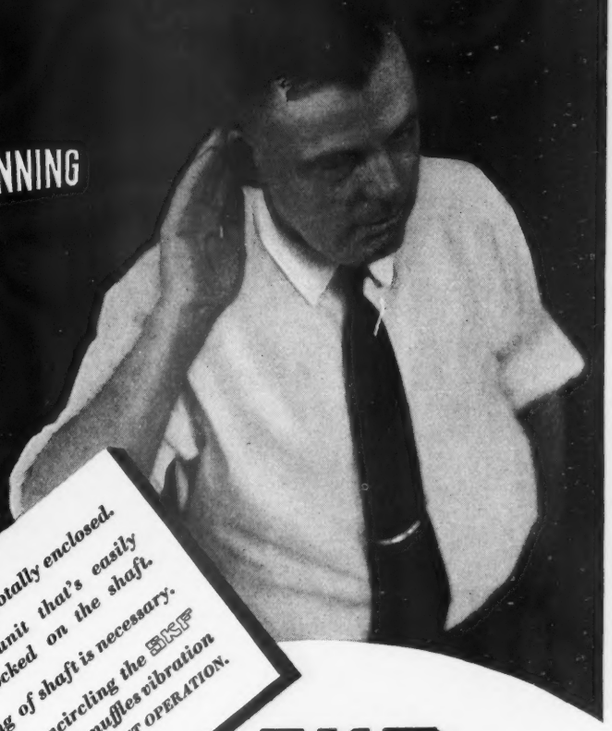

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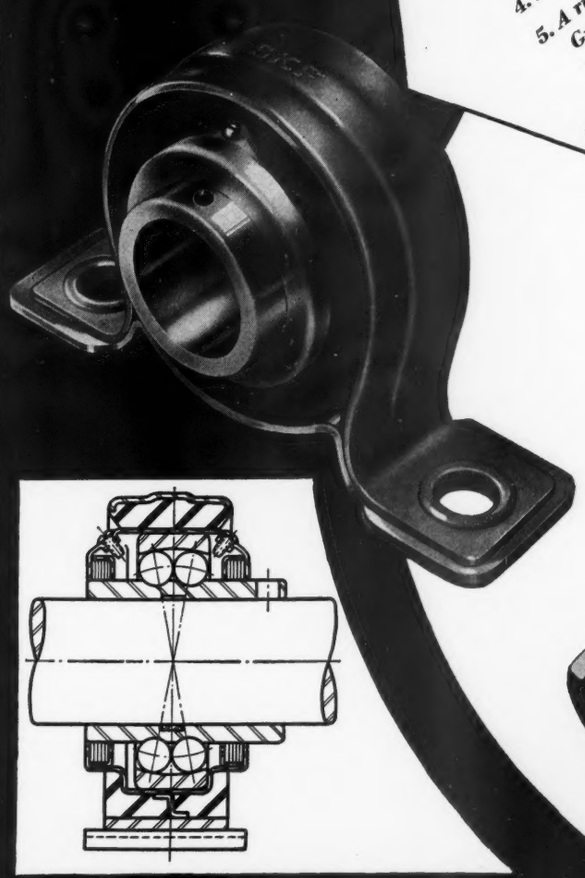

SKF
BALL & ROLLER BEARING
PILLOW BLOCKS

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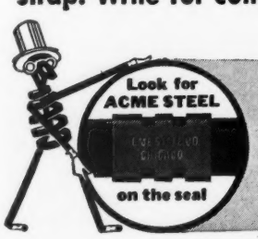
20,000 Customers
BUILT THIS TOOL FOR YOU

The money-saving and time-saving experience of over 20,000 customers has been important in the development of the Acme Steelstrap system. The new No. 2 Steelstrapper combines stretching, sealing and cutting operations with an automatic seal feed. It is the latest addition to a complete line of tools designed for the sole purpose of helping shippers to economically apply Steelstrap and make shipments "Bound to Get There." One or more of these Steelstrap tools will exactly meet your requirements and provide maximum economy.

Acme Steelstrap is sold *only* by Acme sales engineers. They are competent and fully qualified to make practical suggestions for safer, more economical packings of any type of product shipped in any kind of wrappings and containers.

Doc Steelstrap has had over 55 years of experience in helping manufacturers reduce their packing and shipping costs. He will be glad to tell you the amount which *you* can save by using Acme Steelstrap. Write for complete data, today. There is no obligation.



ACME STEEL COMPANY
2831 ARCHER AVENUE, CHICAGO, ILLINOIS
BRANCHES IN PRINCIPAL CITIES

How much does Air Compressor Maintenance cost YOU?

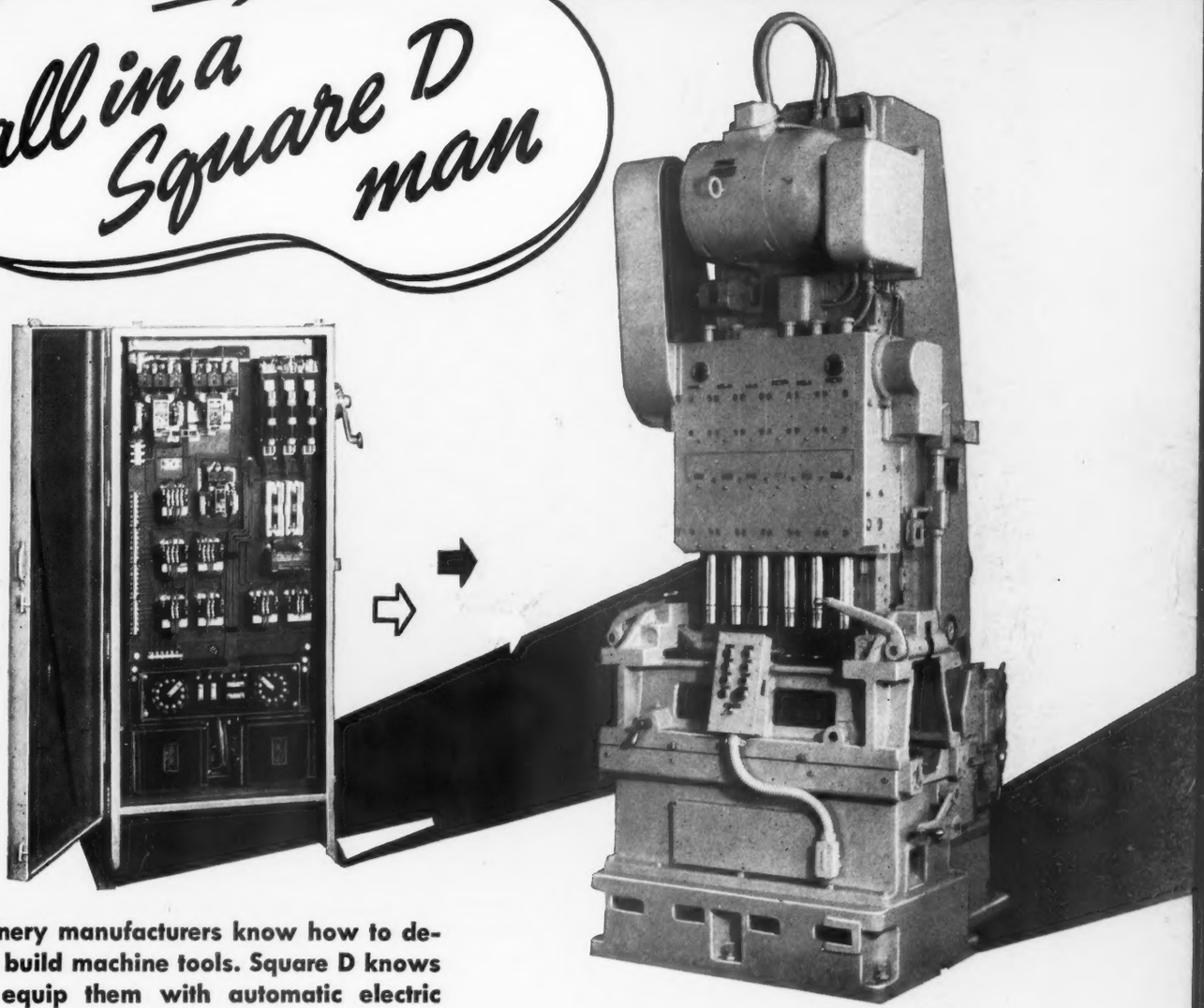
● *Look ahead* when you invest in an air compressor! How much will it be costing you for maintenance one year—five years—ten years—from now? How well will it *keep* its efficiency? Many users of Gardner-Denver "HA" Horizontal Air Compressors are still operating their compressors at high efficiency after years of continuous service! One operator writes that his Gardner-Denver compressor has averaged only $2.06 per month for maintenance over a period of 8 years—and this small sum represents the total necessary to keep the compressor in perfect repair.

Gardner-Denver "HA" Compressors have special features that insure low maintenance and high overall efficiency—features that you should know about before buying any compressor. You owe it to yourself to get the complete information contained in our bulletin "HAC-36." Write today for your free copy. Gardner-Denver Company, Quincy, Ill.

GARDNER-DENVER 80th ANNIVERSARY YEAR

WHERE MOTOR CONTROL PRESENTS A DIFFICULT PROBLEM . .

Call in a Square D man



● **Machinery manufacturers know how to design and build machine tools. Square D knows how to equip them with automatic electric motor control. Working together, they produce some remarkably fine results.**

Here is an example of such teamwork. A six-spindle, hydraulic feed, cylinder boring machine for high speed production of automotive engine blocks. Maintained accuracy within .0005 inch for roundness and straightness of bores. Production rate ranges from twenty to twenty-five blocks per hour.

The normal production cycle is fully automatic. The pressing of a push button starts the cycle; the relays and contactors of the controller act with proper timing and sequence to guide the machine through seven stages of the operating cycle and return it to the starting position. The control is also selective and any function of the cycle may be performed independently.

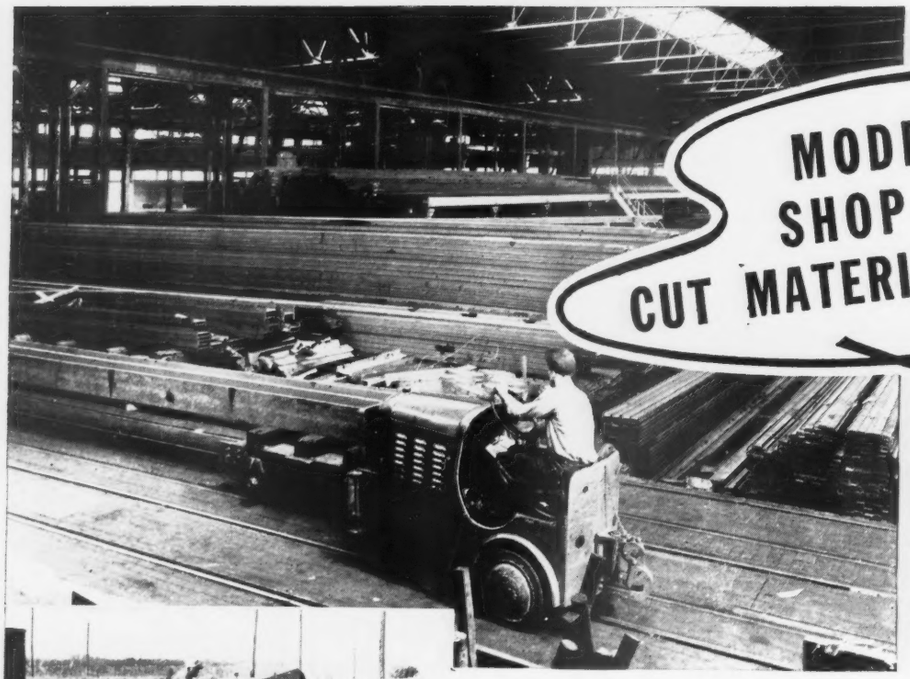
Square D engineers are working constantly with the designers and users of many kinds of motor-driven machines. Their experience and counsel is yours for the asking. There are Square D sales offices, with engineering field service, in all large industrial centers. Call in a Square D man.

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

MODERN SHOP TRUCKS CUT MATERIAL HANDLING COSTS



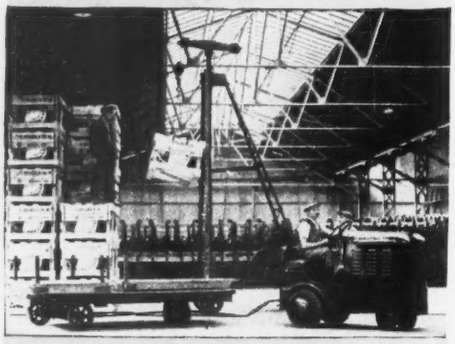
Timken Bearing Equipped "Shop Mule" at work in the plant of Joseph T. Ryerson & Son, Inc.

Tapered Roller TIMKEN BEARING EQUIPPED

A symbol of quality for any piece of equipment with which it is associated

Timken Bearing Equipped "Shop Mule" discharging rubbish picked up in nearby foundry.

Timken Bearing Equipped "Shop Mule" hauling reclaimed rubber.



Timken Bearing Equipped "Shop Mule" unloading farm implement wheels in a modern factory in Paris, France.

In the shop trucks you are about to buy are the wheels, differential, pinion and other parts subjected to hard service equipped with TIMKEN Bearings? If so, you are assured of dependable, low cost performance for years to come. Because Timken Bearing Equipped shop trucks and trailers operate so smoothly, wheels last longer; floors are not subjected to so much wear and tear; and damage to material being hauled is prevented.

The Timken Bearing Equipped "Shop Mules" illustrated here are built by the W. F. Hebard Co. These units are equipped with TIMKEN Bearings throughout—a practice followed by many leading shop truck manufacturers. There are a large number of different makes of Timken Bearing Equipped shop trucks designed for your particular haulage problem.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN

TAPERED ROLLER BEARINGS